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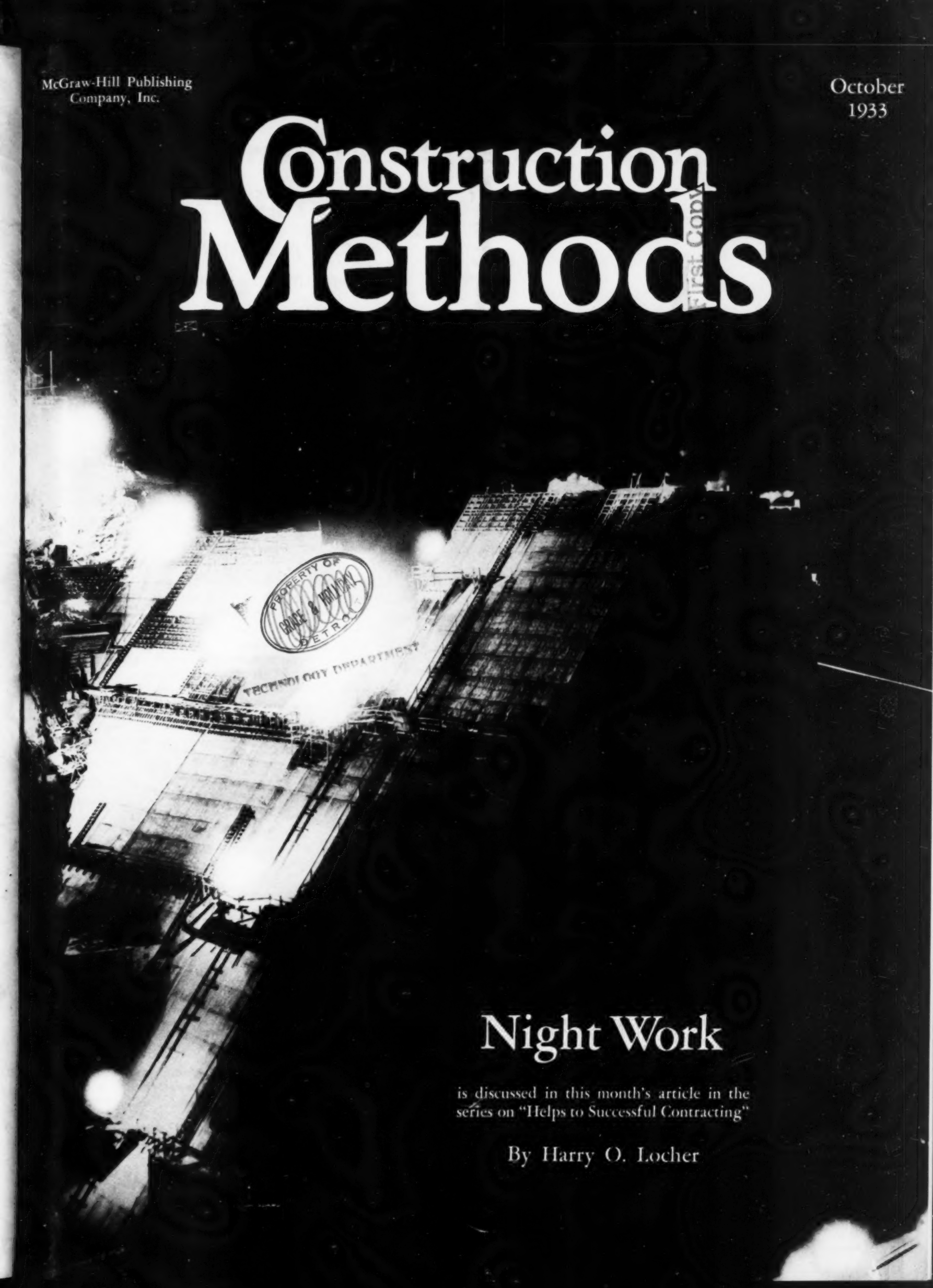
October
1933

Construction Methods



Night Work

is discussed in this month's article in the series on "Helps to Successful Contracting"

By Harry O. Locher

Construction Methods

Mc-Graw-Hill Publishing Company, Inc., 330 West 42nd St., New York
ROBERT K. TOMLIN, Editor
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WILLARD CHEVALIER, Publishing Director

Progress on Public Works Program

● Since last month there have occurred important developments affecting the $3,300,000,000 Federal emergency program of public works construction which had become a target for widespread criticism of delay in putting this fund to work to supply jobs in the field and to stimulate employment in the so-called capital good industries upon which construction calls for its heavy equipment and materials:

Local Projects

● State organizations for examining and approving local projects to receive 30 per cent grants and loans of federal funds under the Public Works Administration's decentralized set-up were completed by the appointment of state engineers to furnish technical counsel to the state advisory boards consisting largely, although not exclusively, of laymen without engineering or construction background. The result marked a new phase of the public works program which heretofore had dealt almost entirely with allotments for Federal projects. Now, with the newly formed decentralized state organizations functioning, allotments are being made at Washington in increasing numbers to *local* projects of cities, counties and states. In non-Federal local works of such types as street paving, schools, waterworks and sewerage projects, distributed widely throughout the country, lies the hope of quick action in transferring men by the thousands from relief rolls to payrolls.

Tentative Allotments

● A new policy under which local authorities may receive, without delay, tentative allotments of Government funds for projects qualified by a prima facie showing as technically and financially sound, has been put into effect by Public Works Administrator Harold L. Ickes to speed up the progress of the public works program. Under the new plan a city project, for example, may receive provisional approval promptly on condition that complete information on engineering and financial features be forthcoming in time for the execution of final contracts within 30 days. This measure was adopted to meet the objections of states and municipalities that were slow to present their projects on the ground that there was no justification of incurring the expense of detailed studies without reasonable assurance of favorable consideration of their plans. The move has been effective in stimulating the flow of local project applications, through the state organizations to Washington.

Technical Review Board

● Further to speed up the placing of contracts for local work the Federal Emergency Public Works Administration has appointed a technical board of review to consider particularly difficult or controversial projects and to hear appeals. This board will consider projects adversely reported by the state boards or the staff in Washington, projects protested by outside parties and projects of unusual size or character involving questions of engineering, finance or law that appear to warrant collective consideration.

Talburt, in the New York World-Telegram.

Open Up That Umbrella!

As the basic capital-fixing agency of our economic life, construction determines the well-being of scores of industries and hundreds of thousands of workers and employers whose products find their markets in the structures that engineers design and contractors build. In 1929 every tenth person of the 48,000,000 gainfully employed in the United States depended for his livelihood on construction. To service that industry required the payment of $7,000,000,000 to 4,500,000 workers, of whom more than half—2,500,000—were engaged directly on construction, while the remainder were employed in industries producing the materials and the machinery required by construction.

Today the majority of those workers normally dependent upon construction for their livelihood are jobless. With full speed demanded by the unemployment crisis, the Government's $3,300,000,000 *emergency* public works program has been proceeding at a snail's pace. It is true that substantial sums have been allotted to Federal works, but the backbone of reemployment must be supplied by the *local* projects of cities, counties and states, aided by federal loans and by outright grants of 30 per cent of the cost of labor and materials. In the present storm of unemployment local authorities, through failure to initiate construction projects under exceptionally favorable terms of federal aid, are plodding through a downpour with folded umbrellas under their arms.

Housing

● In the handling of housing projects the Federal Public Works Administration has exhibited a much greater capacity for action than on other phases of its program. Under the direction of Robert D. Kohn, past-president of the American Institute of Architects, the Housing Division has adopted a definite policy favoring low buildings on low-cost land and against the creation of additional "vertical slums." Recent figures indicate approved allotments of $36,000,000 for housing projects widely distributed throughout American cities.

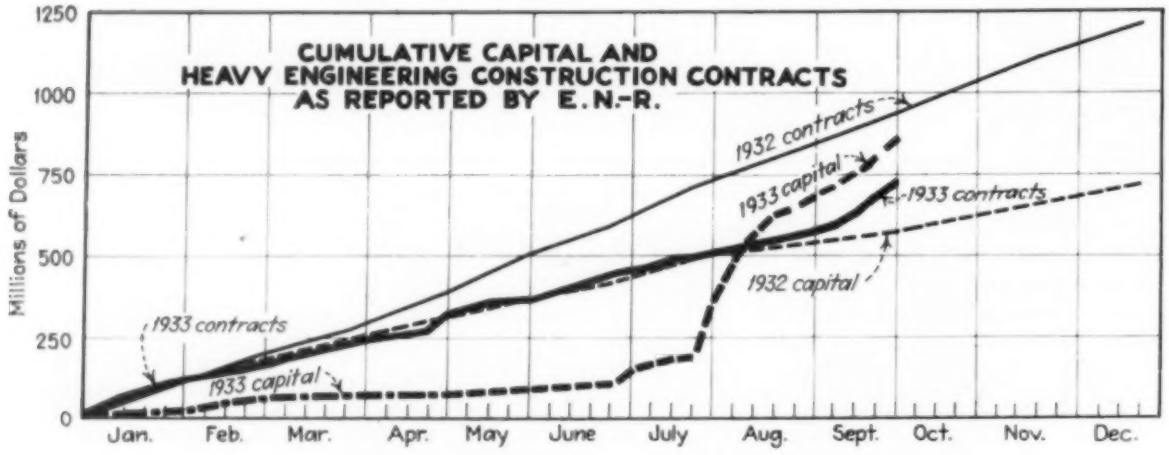
Prequalification a Code Requirement

● In the codes of fair competition both for general contractors and for highway contractors, offered for approval by the NRA, as supplemental to the master construction code on which a public hearing occurred last month, it should be noted with satisfaction by responsible contractors that there has been included a clause requiring all bidders to file verified performance records and financial statements as evidence of competency. The Bureau of Contract Information, Inc., Washington, D. C., or such other agency as may be designated by the NRA, is to receive, classify and make available this information.

Since 1929, the Bureau of Contract Information, an independent, non-profit-making institution, has been assembling and verifying performance records of contracting concerns and releasing information on these records to persons legitimately entitled to it by reason of their responsibility for the award of contracts, the writing of contract bonds, or the extension of credit. During this period, the bureau has won the almost unanimous approval and cooperation of all responsible elements in the construction industry.

In the ensuing period of expanding construction under the proposed codes of industry self-regulation, the bureau undoubtedly will be called upon to perform a much greater task of gathering and supplying performance data than heretofore. To carry on this work it must depend upon additional support from sources which in the past have made only desultory contributions to its maintenance. Because the work benefits every reputable concern involved in the construction business, it is not too much to expect that the support will be forthcoming.

New Business for Someone



THIS CHART, reprinted from our associate journal *Engineering News-Record*, is significant. It is a record of progress already made and a guarantee of greater progress during the weeks just ahead of us.

The heavy broken line shows the amount of capital that has been released for new construction since the first of the year. The heavy solid line shows the volume of the construction contracts that have been awarded to date.

Observe the striking rise in the "capital" curve that began in July soon after the passage of the Public Works Act. Note that early in August it crossed the 1932 line and that it still is headed steadily upward.

This curve represents money that will soon be converted into contracts. It is the forerunner of business for contractors, materials producers and equipment manufacturers. It means orders for someone.

Note that already the "contracts awarded" curve has begun to respond to the rise in the "capital" curve. Here are some figures that show clearly the rate at which this new capital is finding its way into contracts:

Average weekly volume of contracts awarded in July	$12,592,000
Average weekly volume of contracts awarded in August	14,813,000
Average weekly volume of contracts awarded in September	26,669,000
Volume of contracts awarded during week of Sept. 28	41,206,000

HERE IS EVIDENCE of substantial progress in the all-important task of putting new capital to work, making more jobs for men, more contracts for constructors, more orders for the producers of materials and the manufacturers of equipment in the immediate future. Much of it, of course, represents the expenditure of funds made available under the Public Works Act. But it includes also a substantial sum for private construction.

Especially heartening is the increasing effort of the Administration to stimulate the capital goods industries of which construction is so vital a part. The President is seeking ways and means to provide new credit and to release available capital for the use of private industry and the railroads. The Public Works Administration, now fully organized, is putting pressure on local communities the country over to get their works under way.

We are not interested in discussions as to the blame for past delays; that is a futile pastime. We *are* concerned that every element in the construction industry now do what it can to insure continued progress; that is the paramount need.

IT IS A TIME for communities to forget political differences and unite for immediate action. It is a time for engineers and architects to stimulate hesitant employers or clients. It is a time for contractors to show their utmost skill in planning, bidding, and operating; to replace outworn and obsolete plant with new profit-making equipment. Competition is keen; they cannot afford to dally with a load of iron when hard-hitting and trustworthy equipment is so necessary to cut costs. It is a time for manufacturers to strengthen their sales and advertising efforts, that engineers and contractors everywhere who are figuring on jobs may know what is available in the way of better materials and more efficient tools.

In short, the time has come for aggressive attack along the entire front. More and more it becomes evident that **1933 will yet reward the self-starters.**

Willard Chevalier

Publishing Director

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in step with Construction Progress

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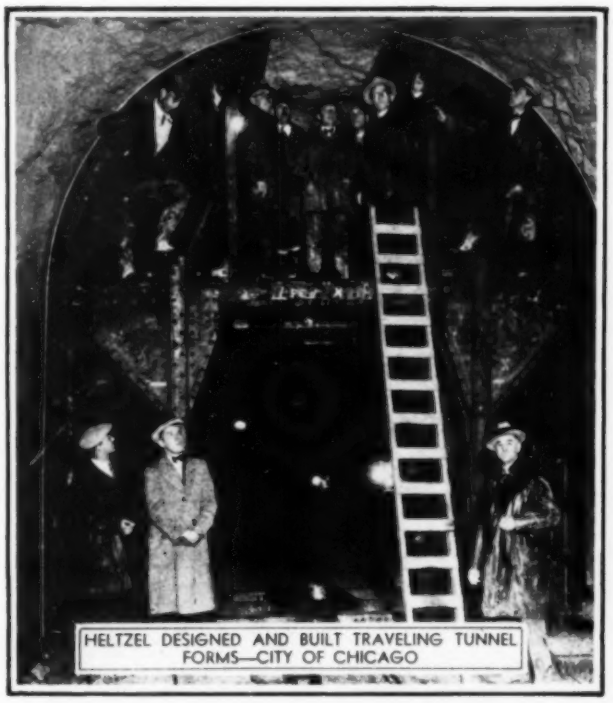
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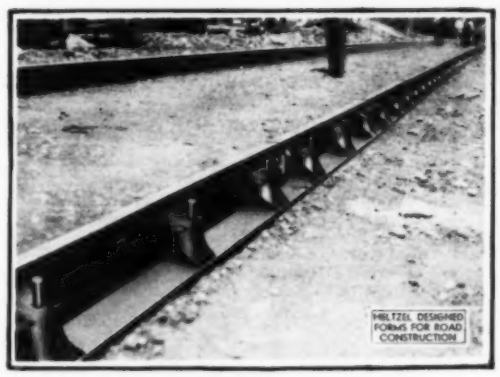
Steel Forms—For building Roads and Sidewalks. Steel Bins—Portable Batching Plants, Cement Bins, Central Mixing Plants, Rectangular, Square or Circular Bolted Bins, Batchers and Scales. Mechanical Spreader and Surfacer, Bituminous Coating Machines, Road Joint Installing Machines, Finishing Tools and Miscellaneous Equipment. Forms for Manhole, Sewer and Tunnel. Steel Plate Construction. Special Equipment.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HELTZEL STEEL ROAD FORMS

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Steel Products to customers' specifications for Asphalt Plants, Blast Furnaces, Breweries, Chemical Plants, Cement Plants, Coal Dealers, Coal Mining Companies, Contractors, Engineering Companies, Factories, Foundry Equipment, Glass Plants, Mines, Oil Industries, Power Plants, Road Building, Rubber Industries, Sand and Gravel Plants, Steel Industry, Wire Mills, Zinc Smelting.

THE HELTZEL STEEL FORM & IRON COMPANY

WARREN, OHIO

CHOOSE YOUR TRUCK CORRECTLY

—*with the* REO PERFORMANCE GAUGE

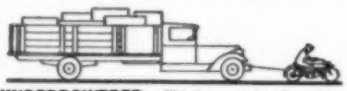
FAILURE to pick the right truck for the job is often responsible for losses in time and money that might easily be avoided by use of the Reo Truck Performance Gauge.

With mathematical accuracy, this ingenious, copyrighted slide rule tells you exactly what specifications a truck should have to operate with maximum long-life and economy under any given conditions.

With such information available for the asking, why add another truck to your equipment without first finding out for yourself—instead of taking the word of an optimistic salesman—whether it is the one best suited for the job?

There are no claims or guesses involved when you apply the Reo Performance Gauge to a problem in transportation. Just facts—and you draw your own conclusions.

Would you like the Reo Slide-Rule check-up? No obligation. Write Reo—or 'phone your Reo dealer.



UNDERPOWERED—This unit is so underpowered that gear ratio "doctoring" is necessary to compensate. The result: increased piston travel and gas consumption; reduced daily range of travel.

BAD LOAD DISTRIBUTION—This truck has more load back of the rear axle than ahead of it. Very hard on rear tires, axles, gears, bearings, springs and frame. Steering and front brake efficiency greatly reduced when climbing hills.

WRONG GEAR RATIO—Here is a truck that is geared so low for occasional heavy pulls that the engine races and shakes itself to pieces trying to make time on level roads.

You may call in the local Reo man or write Reo headquarters for the Reo slide rule check up without obligating yourself in any way. A convenient method of obtaining valuable preliminary information is to write for the Reo Truck Work Sheet, upon which you may list data which will enable Reo to tell you the right power, capacity and wheelbase needed in your operation for the most satisfactory truck performance. Just write Reo, Lansing.

● Reo today offers the finest line of Speedwagons, Trucks and Tractors in Reo history—at the lowest prices.

GOLD CROWN ENGINE—FOUR-WHEEL INTERNAL EXPANDING HYDRAULIC BRAKES—THICK WIDE-FLANGED FRAME—CORRECTLY TIRED—REO LONG LIFE AND ECONOMY.

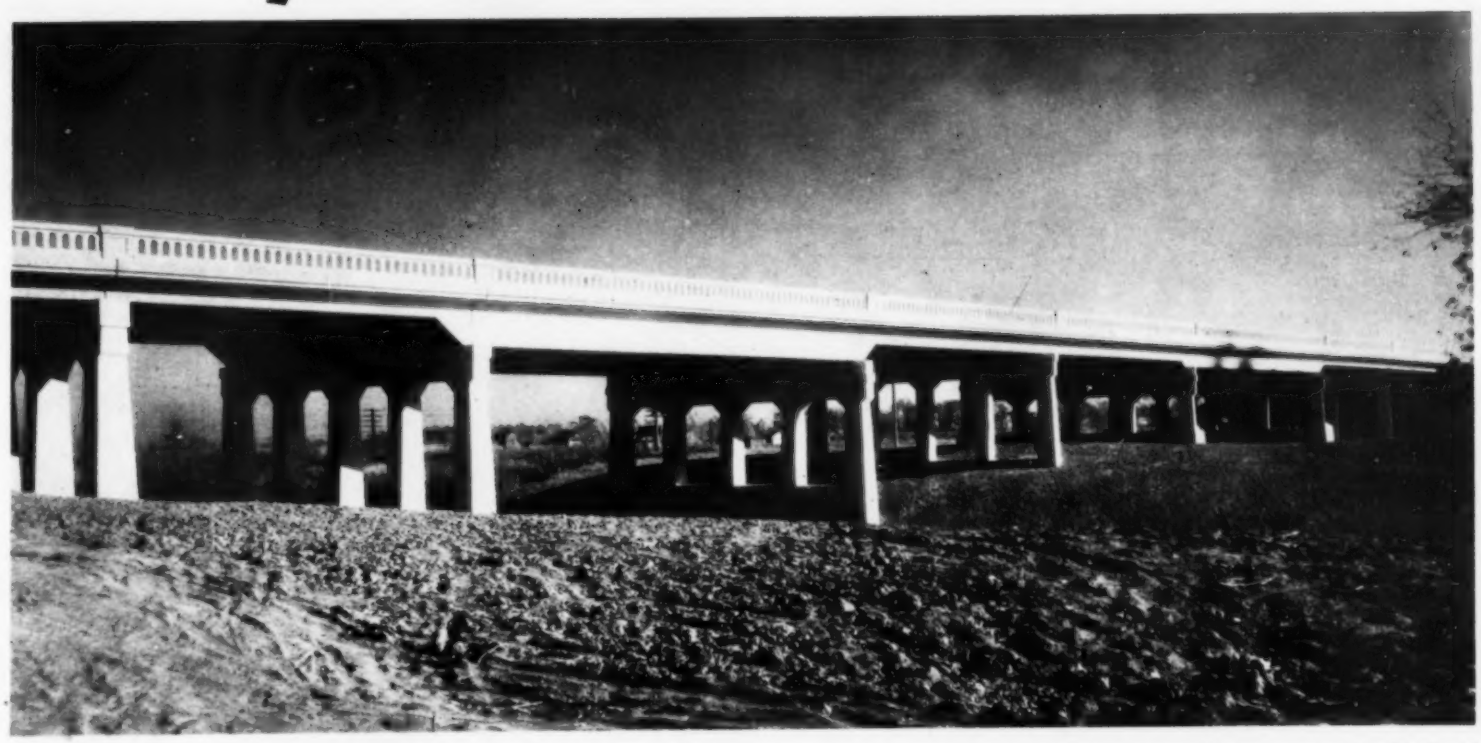
Reo Speedwagons and Trucks range from 1½-6 Tons. Price Range—$575-$2,595. 34 wheelbases, 4's-6's-8's.

Tractor-Trailer units from 15,000 to 32,000 pounds, gross. All prices chassis f. o. b. Lansing, plus tax

$575 AND UP

REO MOTOR CAR COMPANY, LANSING—TORONTO

76 foot span in this concrete deck girder viaduct—



Harlem Avenue Viaduct over the I. & M. Canal and the Alton Railroad. Built for the Commissioners of Cook County (Illinois). Designed under supervision of George A. Quinlan, Superintendent of Highways, Cook County; E. J. Albrecht Co. Chicago, Contractors.

modern engineering and quality-controlled concrete make this economically possible

This viaduct is of the reinforced concrete deck girder type throughout. Spans range from 45′ to 76′ in length. **A working stress of 1,000 pounds per square inch was used in the design of this structure.** Proper use of the strength of high quality concrete contributes to the feasibility of long span concrete bridges.

Careful attention to form building and all construction methods gave a finished bridge of beautiful line and surface, adhering to the designer's conception. The beauty of the finished structure is a tribute to the excellence of design and the skill of experienced workmanship.

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Write today for our booklet "Concrete Bridges" containing discussion of control of concrete quality, illustrations of bridge types, and methods of surface finishing.

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HERE'S HOW GOODRICH ELIMINATES MAJOR CAUSE OF TIRE FAILURE

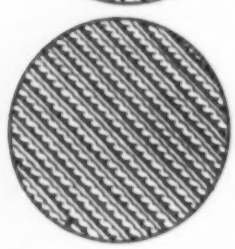
...SO HE EQUIPPED ALL THEIR TRUCKS WITH GOODRICH TIRES

OLD-TIME CROSS-WEAVE FABRIC

The old-style fabric tires failed often . . . ran HOT. Friction at every cross of the weave caused them to break down quickly.

MODERN CROSS-WEAVE CORD-FABRIC

The "Cord" construction used on most tires today an improvement, but still has friction-causing cross-roads.



GOODRICH 100% FULL-FLOATING CORD

Goodrich uses the only type of construction that eliminates cross-cords entirely, making a tire that is 100% full-floating CORD.

TONS of rock and sand . . . bumpy roads . . . and a construction contract to be lived up to. No time for breakdowns. No job for an ordinary truck tire.

Which makes it easy to understand why Goodrich Heavy Duty Silvertowns are the first choice of construction experts who haven't time to listen to "hard-luck" stories about tire failures.

Thanks to special equipment used by Goodrich, it is now possible to make truck tires with *no* cross-weave whatever. *This is the only type of tire construction that eliminates cross-cord friction.* Each separate cord is full-floated in live rubber — does not touch any other cord!

Not only that, the new Heavy Duty Silvertown has a 15% thicker tread that laughs at wear and tear . . . husky double cleats and 22% greater road contact area . . . 22% heavier gum fillings which reduce destructive internal friction to a minimum. Small wonder that on thousands of tough jobs these extra-rugged tires practically pay for themselves in the reduced number of breakdowns and delays alone. Equip all *your* trucks with Goodrich Safety Silvertowns and save money!

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Can you or your company afford to be without this tire on all your trucks when you know it's one sure way of avoiding costly breakdowns—when you can get so much tire value for so little money. Before prices rise any higher, see your nearest Goodrich dealer. Or ask him to call on you.

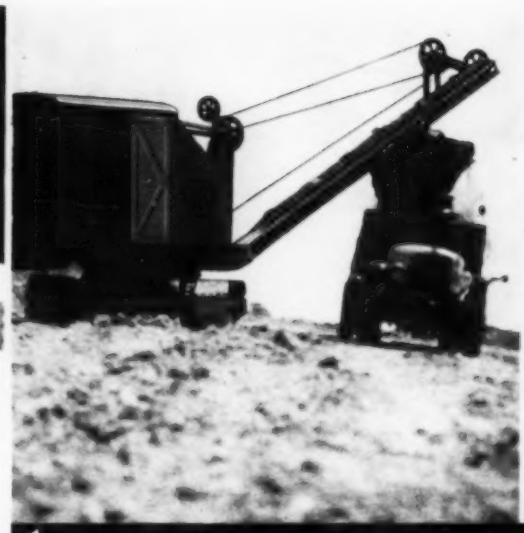
Goodrich *Safety* Silvertowns

Specify Goodrich on all your Trucks

4 SHOVEL UTILITIES *on* ONE BOOM

CHANGE IN TWO HOURS
INSTEAD OF TWO DAYS

for every
type of road, street,
bridge and sewer work



1· PLUNGER SHOVEL

2· TRENCH SHOVEL

3· CRANE

4· HAMMER

THE new Keystone Model 18 is a full-revolving convertible excavator with distinctly new and different time-saving features. ¶ The four important shovel utilities shown above, all originated and developed by Keystone, are usable on ONE boom. Each interchange of utilities can be made in less than two hours, instead of two days required when boom changes are necessary. The first of these utilities, the Plunger Shovel, reduces unit cost on the AVERAGE highway grading job from 15% to 60% compared with the best dipper shovel. (Keystone makes both.) ¶ Many different jobs which in the past have been done at excessive cost because of the great loss of time involved in changing shovel utilities, can now be done at a fraction of their former cost. Among these jobs are channel changes, breaking pavements, ditching, excavating for bridge abutments or culverts, and any task requiring customary crane boom utilities for short periods. The demolition hammer attachment is the latest utility originated by Keystone. ¶ Write for the new Keystone Model 18 catalog illustrating and explaining these unique new features. Keystone Driller Company, Beaver Falls, Pa. (Established 1882) Branches: Arlington, N. J. Birmingham, Ala. Joplin, Mo. Waukegan, Ill.

KEYSTONE 18

DU PONT EXPLOSIVE

made especially for every type of work!

SIDE HILL CUTS

IF in hard rock, use Quarry Gelatins. Softer materials may be successfully handled by Red Cross Extra grades, or in dry work Free-Running Red Cross Blasting or granular black powder may be used.

In working from the side, slight variations are made, depending on whether excavated material is to be used for filling or is wasted down the hill. If it is to be used for filling, the loading should be barely heavy enough to break the ground for convenient handling. In working from the end, the rules for thorough cuts apply, and the same explosives are recommended.

STUMPS

STUMPS in firm soil are more easily blasted than when located in sandy soils. For blasting green, lateral rooted stumps, use 40% Red Cross. For tap-rooted stumps, use Agritol, or, if soil is heavy, Red Cross Extra 20%; if light soil, use Red Cross Extra 40%. To blast tap-rooted stumps out of light soil, use Red Cross Extra 40%.

For blasting the big stumps in the Pacific Northwestern States, use Du Pont Loggers' Powder.

QUARRYING

IF stone is to be crushed for road building, use Red Cross 40%, Du Pont Extra, Gelatin, or Gelex. Holes should be well tamped and charges fired simultaneously.

For quarrying dimension stone, use blasting powder of fine granulation to start cracks and seams in the desired direction. For extremely hard rock of the granite or trap types, Du Pont Quarry Gelatin should be used.

GRAVEL PITS

BLASTING is effective for speeding up excavation to obtain grading material. Bore holes are spaced about as for other blasting. If rock is not encountered, holes are loaded much lighter — the object being to loosen the material sufficiently to make digging easy. Use Red Cross Extra 20% and Red Cross Blasting No. 2 F. R. for this work.

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FILL SETTLEMENT

DYNAMITE can be effectively employed for removing muck and other unstable material from roadbeds. Dynamite is exploded to create cavities for the fill to drop into, and also to stir up and liquefy the mud surrounding the cavity to permit the rapid settlement of the fill.

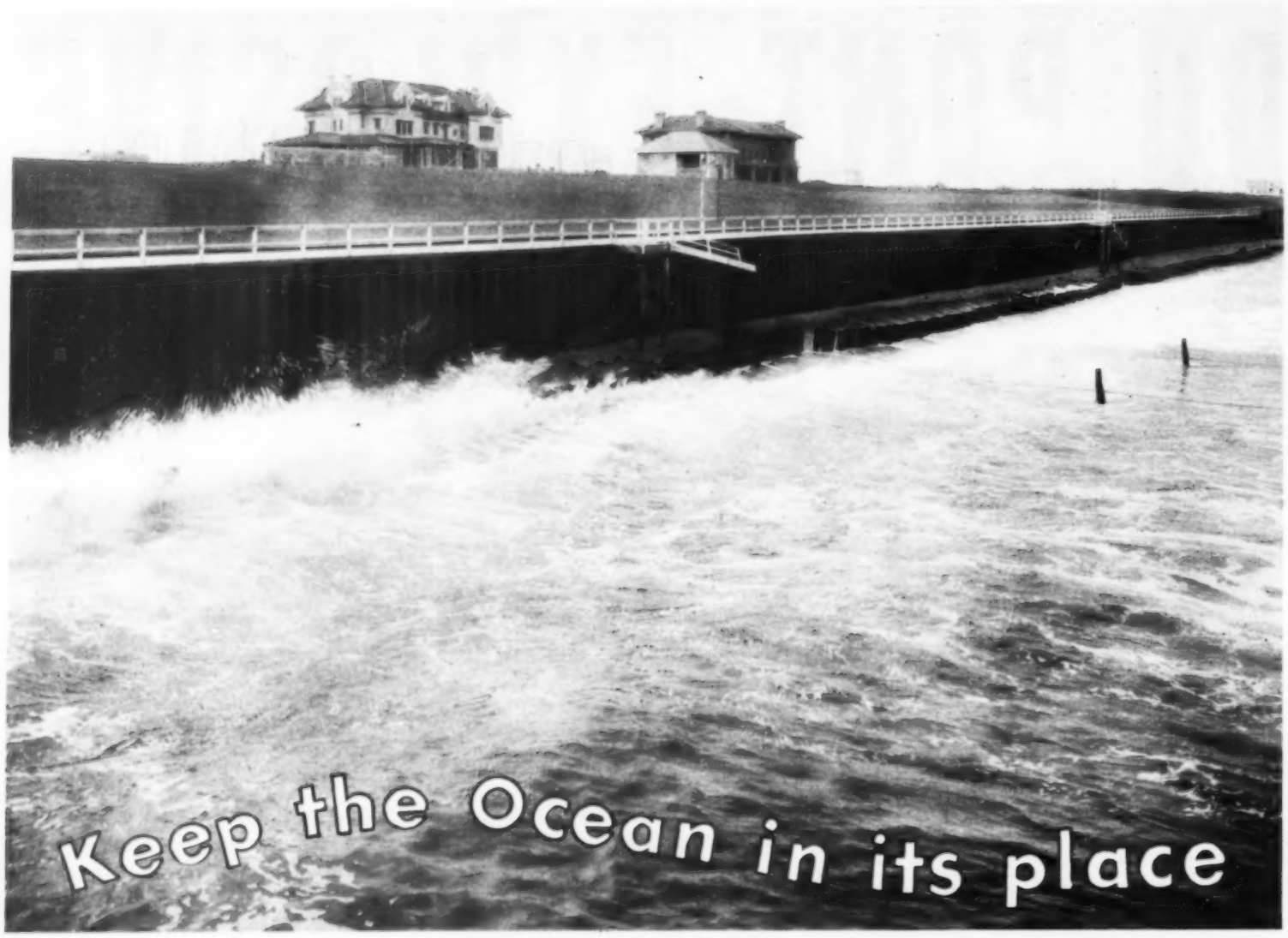
Du Pont Ditching Dynamite is particularly effective, because of its water-resisting and propagating qualities.

If necessary to place the explosive under the fill, use Du Pont 40% Gelatin in large-size cartridges.

DITCHING

DITCHES can be blasted in wet soil by the propagation method; or the electric method can be used in wet or dry soil.

In wet soil, the propagation method, when used with Du Pont Ditching Dynamite, simplifies drainage construction and effects economies in time, labor and money. Ditching with dynamite is frequently successful where conditions make other methods impractical.



with Steel

The summer vacationist seldom has an opportunity to realize the violence of which the storm-tossed North Atlantic is capable.

This 1500-ft. bulkhead at Deal, N. J., built of Bethlehem (Lackawanna) Piling in 28-ft. lengths, will offer firm resistance to the wildest winter storms, keeping the fine residences and broad, sloping lawns that border the sea at this point secure from attack.

Thomas Procter Company, Long Branch, N. J., Contractor

The lower photograph shows another portion of this same bulkhead under construction. After completion of the bulkhead, groins of Bethlehem (Lackawanna) Piling will be constructed to build up the beach.

Bethlehem (Lackawanna) Steel Sheet Piling offers important advantages in shore-protection structures. It is readily driven or jetted to depths that can be attained with other materials only with difficulty and at greater cost. It forms a wall with strong, sand-tight interlocks between the individual pieces. It is the strongest material available for the building of shore protection structures.

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Subsidiary of Bethlehem Steel Corporation

GENERAL OFFICES: BETHLEHEM, PA.

BETHLEHEM (LACKAWANNA) STEEL SHEET PILING

INFLATED DOLLARS
may turn the trick . . . but lookout for inflated dippers

You can't measure a shovel's production by the size of a dipper alone. Low yardage costs depend on two things: first, how much you can crowd into the dipper every trip; and second, how many times you can fill and empty that dipper per day. Conversation won't help when you're nosing into a big job. Speed — power — flexibility of control: they're the things that count. That's why we urge you to check P&H against all comers on those qualities. The more carefully you check, the surer you are to buy a P&H.

Split Second Control

These outstanding improvements on the new P&H machines speed up operation, cut down waste time, and reduce maintenance.

- Sure Feel Power Clutch
- Full Vision Cab
- Power Dipper Trip
- High-Production Main Clutches
- Rapid Reversing Crowd Planetary
- Super-Smooth Swing Clutch
- Self Starter

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DALLAS LOS ANGELES SAN FRANCISCO

P&H FOR A BIGGER DAY'S WORK

Construction Methods

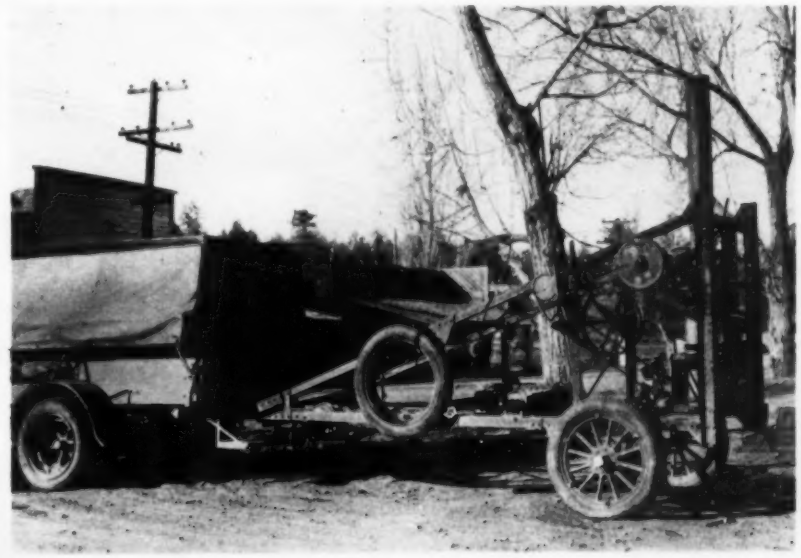
ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 15—Number 10—New York, October, 1933

LIGHT DRILL RIG

Easily Transported, Explores California Bridge Sites



AS A TRAILER, fitted with rubber-tired wheels, the drill rig is easily transported behind a survey party truck.

VARIETY of augers and drills may be operated by rig, depending upon character of subsurface material penetrated.

UP-ENDED in drilling position the rig may be operated as a drill, a sand pump or a 200-lb. trip-hammer hoist.

FOR EXPLORING subsurface conditions at the sites of small bridges, which constitute a large percentage of the structures designed and built by the Division of Highways of the California Department of Public Works, it is often necessary to drill holes to depths of 50 ft. For this purpose A. C. North, assistant bridge construction engineer, developed a portable power-driven drill rig heavy enough to withstand hard usage, and still light enough to be transported easily at maximum speed and lowered into locations difficult of access by a small operating crew.

The drill rig, illustrated herewith, is driven by a 3-hp. air-cooled motor connected with a revolving gear wheel and has sufficient strength to twist a 1½-in. water pipe in two. It operates augers of a variety of shapes which penetrate the substrata and permit material to be withdrawn for study. A small hoist at the back of the rig facilitates the use of either a sand pump, for soft ground, or a 450-lb. churn drill for solid rock. The equipment includes a 200-lb. hammer and driving head for putting down well casing.

The rig is furnished with two rubber-tired wheels and can be attached as a trailer to the rear of a survey party truck. At the site the frame of the rig is merely tipped into vertical position for drilling.

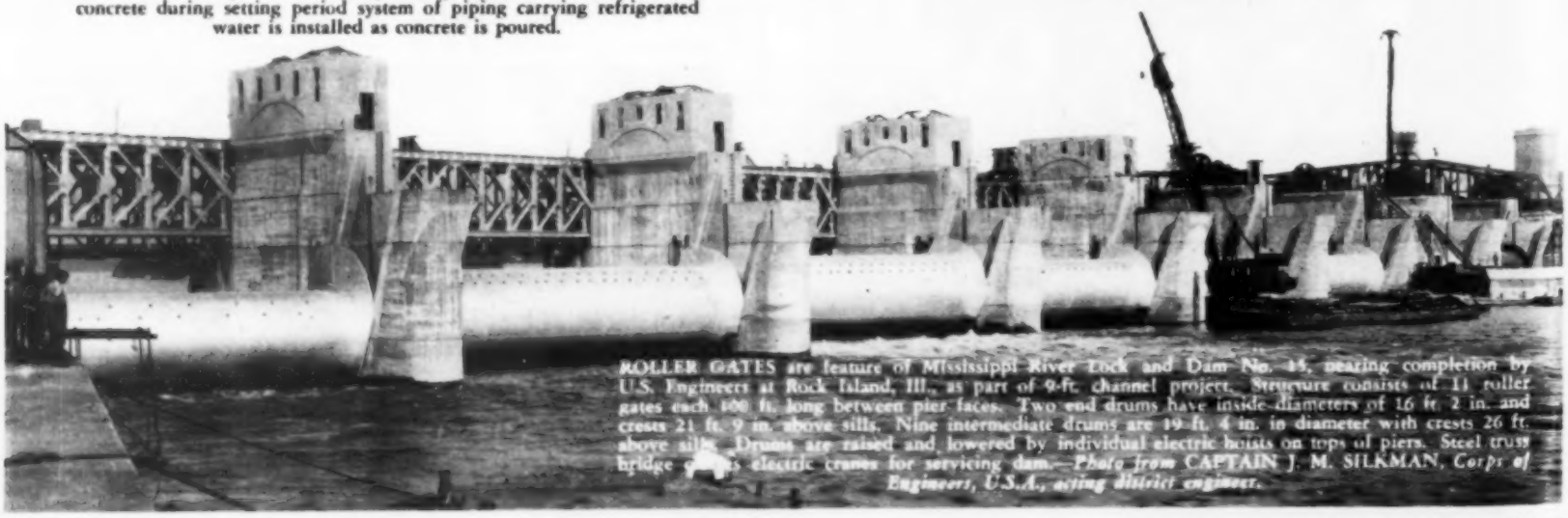
This Month's

"NEWS REEL"

BLUE EAGLE finds perch on contractor's power shovel after long flight to Canal Zone. Al Geddes decorates his 1¼-yd. Lima gasoline unit at work in Panama, with NRA emblem and own slogan of "Codes for 8 is my standard for 6", signalizing shorter working hours for his crew.

BOULDER DAM CONCRETING, in form of blocks 50x50 ft. in plan poured from 8-yd. cableway buckets, is progressing at rate of 6,000 cu.yd. per day. Six Companies Inc. expect to complete entire 3,500,000 cu.yd. of masonry in U.S. Reclamation Bureau's 730-ft. high structure across Colorado River Canyon by the spring of 1936. For cooling concrete during setting period system of piping carrying refrigerated water is installed as concrete is poured.

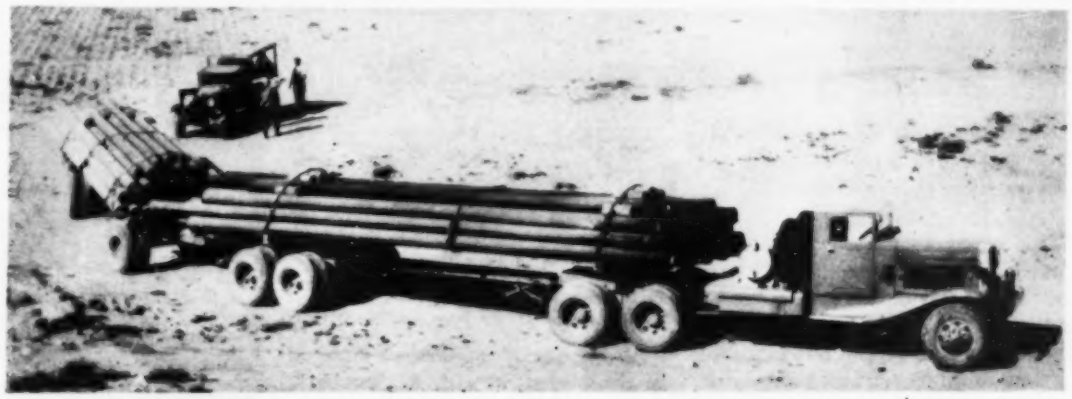
FIRST PAY CHECK under $3,300,000,000 Federal Emergency Public Works program is delivered Sept. 9 to Stanley Pendleton, worker on paving contract in Washington, D. C., by Public Works Administrator Harold L. Ickes, while Thomas H. MacDonald *(at right)*, chief, U.S. Bureau of Public Roads, witnesses ceremony.
Underwood & Underwood Photo



ROLLER GATES are feature of Mississippi River Lock and Dam No. 15, nearing completion by U.S. Engineers at Rock Island, Ill., as part of 9-ft. channel project. Structure consists of 11 roller gates each 400 ft. long between pier faces. Two end drums have inside diameters of 16 ft. 2 in. and crests 21 ft. 9 in. above sills. Nine intermediate drums are 19 ft. 4 in. in diameter with crests 26 ft. above sills. Drums are raised and lowered by individual electric hoists on tops of piers. Steel truss bridge carries electric cranes for servicing dam.—*Photo from* CAPTAIN J. M. SILKMAN, *Corps of Engineers, U.S.A., acting district engineer.*

NO TECHNOCRACY HERE. Hand labor methods are resorted to on large scale by members of the Civilian Conservation Corps in excavating the outlet for the Winooski River flood control project near Barre, Vermont. Operations providing jobs for hundreds of construction workers are being directed by officers of the U.S. Engineer Office, First District, New York City.

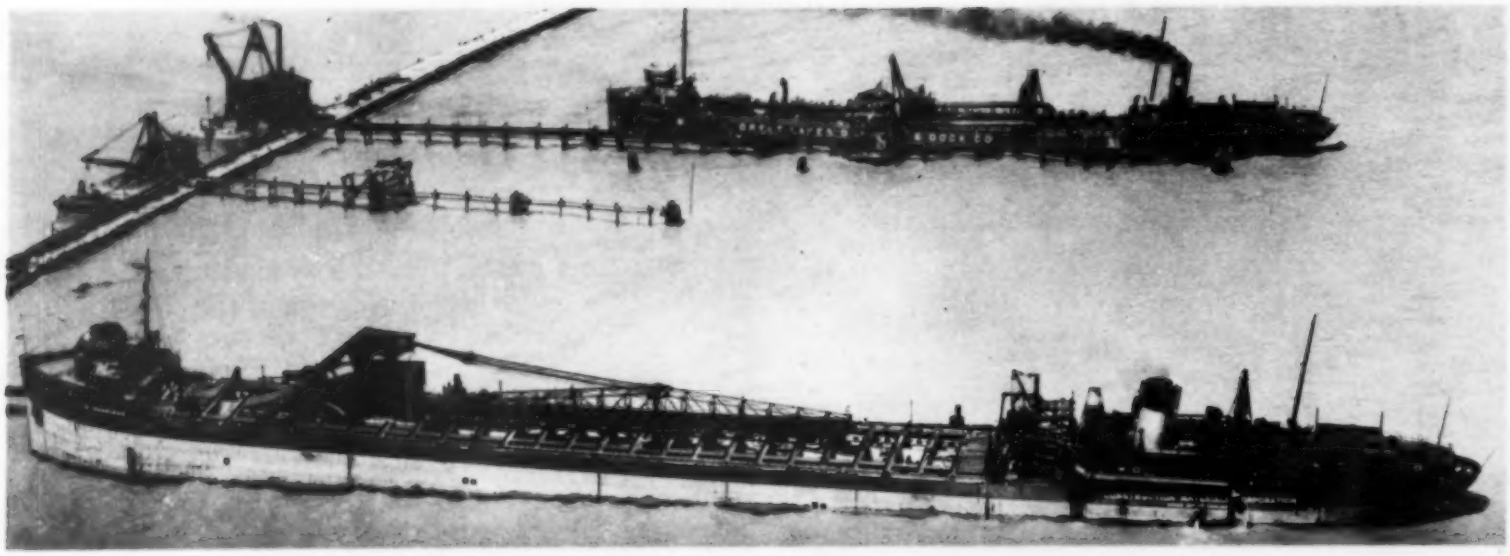
MONUMENT TO LIVING ENGINEER *(below)*. James H. MacDonald (center) octogenarian treasurer of American Road Builders' Association and former state highway commissioner of Connecticut, is honored as "pioneer of highways" by memorial tablet on Avon Mountain in new Connecticut State Park bearing his name. The present highway commissioner, John A. MacDonald (left) and Governor Cross (right) participate in ceremony.



40-TON LOADS of steel pipe for Iraq Petroleum Co.'s 1,200-mi. line serving Near East oil development, are hauled across Syrian desert by six-wheel drive, diesel-powered Marmon-Herrington trucks, pulling semi-trailers and trailers at speeds of 20 mi. per hour. Truck motors are six-cylinder Hercules units of solid-injection, high compression type. Trucks are operated by Nairn Transport Co., Ltd.

Harris-Ewing Photo

CONSTRUCTION INDUSTRY'S CODE MAKERS. Leaders in task of drafting basic rules of fair competition for contractors and engineers under NRA participate in public hearing before Deputy Administrator Malcolm Muir at Washington, D. C. Sept. 6. (Left to right) STEPHEN F. VOORHEES, chairman, and JOHN P. HOGAN, vice-chairman, Code Committee, Construction League of the United States; WILLARD CHEVALIER, publishing director of "Construction Methods"; and A. E. HORST, of Associated General Contractors of America. (Left, rear) B. L. KNOWLES, A.G.C. contractor, of Worcester, Mass.



HOPPER DREDGES tied up at piers at Lincoln Park discharge sand cargoes through shore pipe lines. Turbine-electric motor ship, "J. R. Sensibar," of Construction Materials Corp. is docked at pier in foreground. In background is steam hopper dredge, "Michigan," of Great Lakes Dredge & Dock Co.

Seven Hopper Dredges

Part 1

Add 259 Acres of Fill to Chicago's Lake Front

IN six months starting June 21, 1931, seven hopper dredges excavated nearly 5,000,000 cu. yd. of sand from the bottom of Lake Michigan, transported it 25 mi. and deposited it to form a northerly extension of Lincoln Park, Chicago. The original contract, let to the Construction Materials Corp., of Chicago, called for a fill of 7,000,000 cu.yd. Work has been suspended temporarily, but it will be resumed as soon as conditions permit. When completed, the fill will increase the area of Lincoln Park by 259 acres and will provide additional bathing and recreational facilities for the city's population. Plans already made call for even more extensive future fill to the north of the present development.

Among the seven dredges engaged on the project was "J. R. Sensibar," with a hold capacity of 10,000 cu. yd., largest and most versatile of sand-sucker hopper dredges and bulk-cargo carriers on the Great Lakes. This ship, equipped and operated by the Construction Materials Corp., probably represents the highest development in special-purpose vessels yet built. Its great size makes it an economical cargo carrier on trips of any length but adds to the difficulties of docking in open water in rough weather.

DISCHARGE PIPES are bled by unbolting flanged joints to place sand fill as required. Fill is approaching final grade as indicated by fact that pile bents supporting pipe are almost buried.

SHORE PIPE LINES from pier of Construction Materials Corp. cross area to be filled on pile trestles which serve as permanent supports for pipes and eliminate need of moving and raising lines as filling progresses. In foreground is old-type bulkhead with walls of closely spaced wood piles. Three pipes on pier in foreground are spiral welded. Pipe to left has Victaulic coupling, and two pipes to right have bolted flanged joints.

Bulkheads to retain the sand fill of the Lincoln Park extension were constructed of deep arch-web steel sheet-piles. The bulkhead designs were new for open-water construction on the Great Lakes. One long curved bulkhead and the bathing beach on the lake side of it were located to intercept

LAYOUT OF BULKHEADS, PIERS, AND SHORE PIPE LINES for building 7,000,000-yd. sand fill to add 259 acres to Lincoln Park, Chicago. Pipe lines are supported on bulkheads, dikes, and pile trestles. Outer Drive will be extended north across sand fill. Small suction dredge is excavating boat harbor. Bulkhead parallel with shore and sand fill on land side of this bulkhead extends north some 2,500 ft. beyond limit of photograph.

shore currents and collect sand deposited by the eddy thus formed.

Extent of Development—As indicated by the accompanying aerial photograph, the fill extends east about 5,000 ft. from the end of Montrose Ave. and, from this point, 1,800 ft. north to the hooked end of the bulkhead, which will be carried back in a long curve to connect with the bulkhead parallel to the shore in the left foreground. Part of the fill will be made in front of this curved bulkhead to form the bathing beach. Length of the fill, from Montrose Ave. to the northern extremity, is about 5,500 ft., and the width of the portion parallel to the shore averages about 1,300 ft.

Maximum depth to lake bottom within the area of the fill is 23 ft. The general level of the fill is 8 ft. above mean lake level, but embankments up to 22 ft. above datum are required for the extension of the Outer Drive.

Hopper Dredge Routine—The seven hopper dredges, which varied greatly in capacity and efficiency, followed the same operating routine. Sand was loaded into the holds by pumping from the bottom of the lake off Indiana Harbor, Ind., 25 mi. south of the fill. Transporting their cargoes to Lincoln Park, the dredges tied up at their respective piers and connected their discharge pipes to the land lines through some form of flexible coupling. After pumping the sand ashore by mixing water with the cargo, the dredges returned to the digging point for another load.

Dredge Capacities—"J. R. Sensibar" has a total cubical hold content of 10,000 yd. and a load capacity of 10,000 tons at a draft of 21 ft. 1½ in. A channel 150 ft. wide was dredged to a minimum depth of 22 ft. from the pier to deep water to enable "J. R. Sensibar" to carry 6,000 yd. of sand. Equipped with steam-turbine electric-motor drive, this ship made a full round trip, including loading and discharging, in 8 hours.

Two other dredges of the Construtions Materials Corp. were engaged on the work. "Sandmaster," equipped with diesel-electric drive and two 18-in. pumps, delivered a load of 1,600 yd. every 8 hr. An equal amount of sand was placed in the fill every 8½ hr. by "Sandcraft," a steamship which has two 18-in. centrifugal pumps, each driven by a 300-hp. triple expansion engine.

Three subcontractors operated four hopper dredges on the project. "Michigan," turbine-equipped steamdredge of the Great Lakes Dredge & Dock Co., was capable of placing 3,300 yd. every 8½ hr. Two steam dredges of the Fitzsimons & Connell Dredge & Dock Co. could make complete round trips in 8 hr., "Nassau" carrying 3,000 yd. and "Brazil," 2,200 yd. A converted steam-driven whaleback-type lake freighter, "Bayview," of the Central Dredge & Dock Co., delivered 1,400 yd. per trip and required about 10 hours for the full cycle.

BUILDING SAND FILL by hydraulic discharge from hopper dredges. This kind of fill has excellent bearing power immediately upon being placed, as indicated by workmen walking on surface of newly deposited material. Dike retains fill in right background.

Placing Fill—Referring again to the aerial photograph, it will be observed that the Construction Materials Corp. had a pier 580 ft. long for its three ships and that the subcontractors had a pier for each of their four dredges. These piers extended into the lake from the bulkheads. Pipe lines equal in diameter to the discharge pipes of the dredges were laid from the piers on the bulkheads and on pile trestles. Pipe lines of the four subcontractors were constructed of welded or riveted steel plate sections with slip joints of the bell and spigot type locked by tension chains. Because of its long-wearing qualities when used for hydraulic-fill operation, the Construction Materials Corp. chose Naylor spiral-weld pipe for its 28-in. and two 18-in. lines. For the two 18-in lines, the 20-ft. lengths of spiral-weld pipe were provided with flanges for bolted couplings, but the joints of

the 28-in. pipe were made with Victaulic couplings. As shown in part by one of the photographs, the Victaulic coupling is formed by bolting six steel segments over a rubber gasket covering the joint. All pipes used for actual placing of the sand by the Construction Materials Corp. were equipped with flanged joints which could be unbolted for bleeding at points desired.

To avoid moving and raising the pipe lines as filling progressed, the general contractor constructed long pile trestles on which the lines were placed in semi-permanent position. The dredges pumped about 15 per cent solids through the pipe lines. Length of the lines averaged about 3,000 ft. for "Sandcraft" and "Sandmaster" and ranged from 3,000 to 5,000 ft. for "J. R. Sensibar."

Embankments above the general level of the fill were raised in lifts about

ELEVATED PIPE LINE is placed on pile trestles to build embankments for extension of Outer Drive. Note Victaulic coupling on larger line and flanged joints of smaller pipes.

TYPE OF JOINT *(below)* with tension locking device used on 30-in. pipe line from steamship, "Michigan".

VICTAULIC COUPLING *(below)* on 28-in. spiral welded pipe line from J. R. Sensibar is composed of six steel segments, bolted together, which clamp continuous rubber gasket over pipe joint.

OVERBOARD SUCTION PIPE *(below)* is raised and lowered by two A-frame derricks. Elbow connection is fastened to square plate which slides in vertical grooved track. When dredge is digging sand, overboard suction pipe is lowered until elbow connection engages with suction intake port in side of ship below water line. SUCTION HOOD *(below, right)* used when digging in deep sand, with ship anchored.

6 ft. high by constructing sand dikes covered with canvas to protect them from erosion. Overflow pipes conducted the excess water through the dikes from the center of the pool.

Dredge "J. R. Sensibar" — Nearly $2,000,000 was expended by the Construction Materials Corp. in converting a bulk freighter into the most modern of hopper dredges, "J. R. Sensibar," capable of unloading its cargo, either wet or dry, at the rate of 4,500 tons an hour, and of pumping a distance of 4 mi. Its principal dimensions are a 553-ft. overall length, a 56-ft. molded beam and a 31-ft. molded depth. Many of the mechanical features of the ship were designed for it by the owner, and these features have been patented.

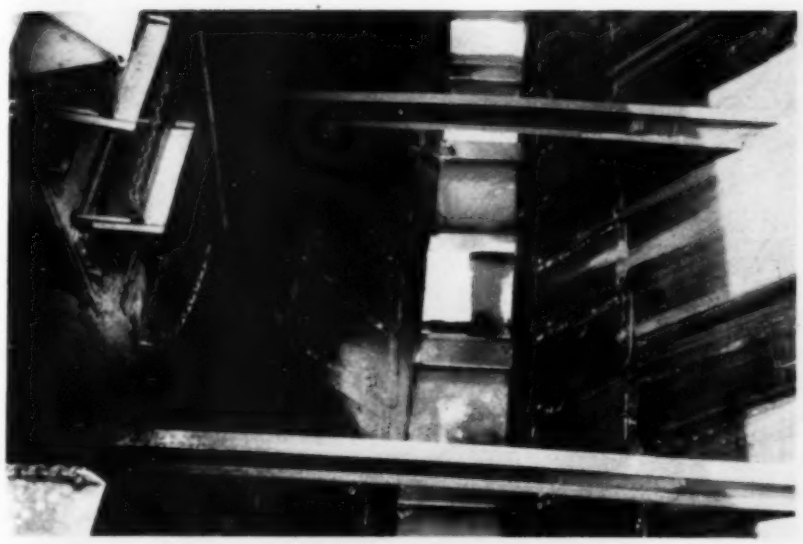
Watertight bulkheads divide the ship into five compartments. At the stern are the fan-tail and engine-room, and at the forward end are the fore-peak and conveyor-machinery space, comprising four compartments in all. The long central portion between the fore and aft parts is taken up by the cargo hold and the equipment for loading and unloading. A long conveyor boom capable of swinging through an arc of 270 deg., for dry unloading, will be described later.

Primary Power Plant—Steam is produced by three Scotch marine boilers at a working pressure of 180 lb. per square inch. Two of the boilers are 15 ft. 9 in. in diameter and 11 ft. long, and the third is 14 ft. 6 in. in diameter and 11 ft. in length. Radiant superheaters placed in the combustion chambers raise the steam temperature 200 degrees as required for efficient operation of the turbine.

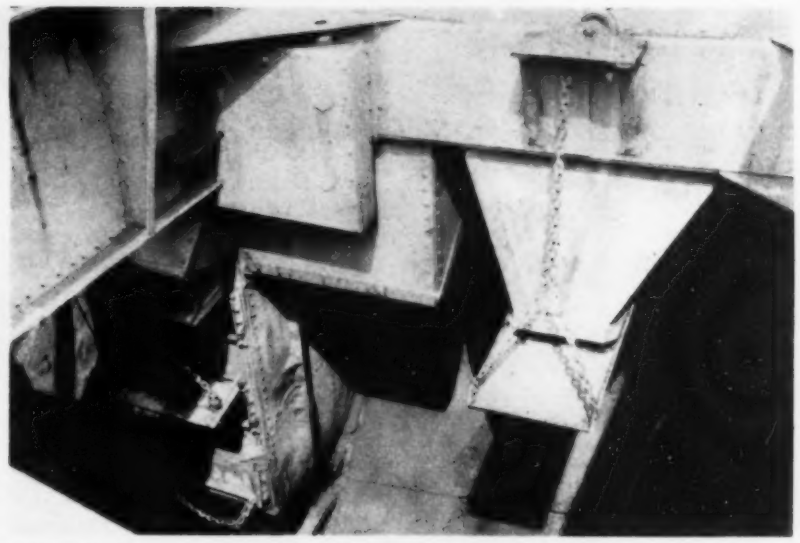
Pulverized coal is fed mechanically to the boiler fires. Run-of-mine coal, carried in the ship's bunkers, is reduced to approximately ¾-in. size by a crusher, this size being required for feeding to the pulverizers. Each of three pulverizers is connected to one boiler furnace by a flexible metallic hose. An oil burner is installed at each boiler for standby firing when the ship is not in service.

Propulsion Equipment—"J. R. Sensibar" is propelled by a G. E. turbine-electric drive consisting of a steam turbine direct-connected to a 3-phase 50-cycle generator operating at 3,600 r.p.m. and delivering 848 amp. at 2,300 v. to one a.c. propulsion motor rated at 3,000 hp. at 100 r.p.m. Speed control provides for 20, 40, 60, 80 and 100 r.p.m. A Westinghouse 750-kva. 3-phase 2,350-v. 50-cycle turbine-generator direct-connected to a 75-kw. 115-v. d.c. exciter is used as an auxiliary unit. This generator can be employed as a motor to drive the exciter when power is available from the main generator. A reciprocating-steam-engine-driven 35-kw. 115-v. d.c. exciter is provided for the propulsion motor. The drive shaft is 15 in. in diameter and is equipped with a Goodrich water-lubricated cutless-type rubber stern bearing.

Cargo Hold—The cargo hold is divided into six compartments by a watertight center-line bulkhead and by two transverse screen bulkheads. The two parallel lines of hoppers separated by the central bulkhead have rivited steel plate walls and bottoms supported by structural steel members from the sides and bottom of the ship. As indicated by one of the accompanying photographs, the sloping sides of each of the two parallel hoppers are equipped near the bottom with panel screens through which water contained in a wet cargo may drain while the load is in



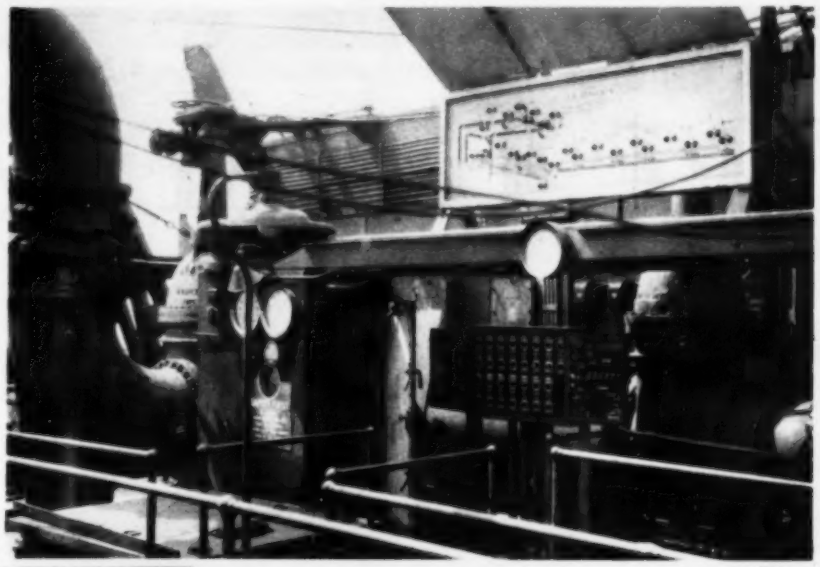
CARGO HOPPERS have sloping sides converging on flat bottom closed by water-tight gates. Near bottom panel screens drain wet cargo. At left is vertical spillway with overflow gates for discharging excess water when dredge is loading. Gates are closed in succession as level of sand in hopper rises.



LOADING GATE, at right, for admitting mixture of sand and water from long flume under deck to cargo hopper. At left is spillway box for draining off excess water. All gates are manually controlled from platforms just under hatch covers.

transit. Each of these panel screens contains two fine-mesh sieves protected by a heavy wire screen from damage by cargoes of coarse material.

As wet cargo is discharged into the hoppers, excess water is carried away through overflow ports, but the deposited material still contains 15 to 20 per cent moisture. The drainage screens permit most of this moisture to escape and enable the ship to carry 2,000 tons greater pay load without increasing its draft. The flat bottom of the hopper is closed by a continuous series of water-tight gates, each 3 ft. wide by 3 ft. 10 in. long, which are opened to discharge upon a belt conveyor beneath when the ship is unloading dry cargo. Operation of the conveyor will be touched upon later.



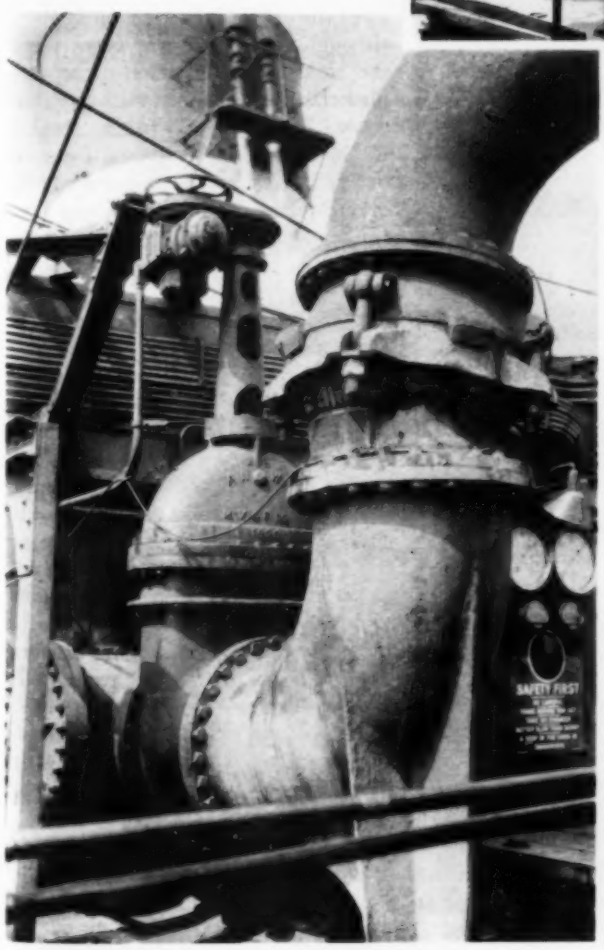
VALVES *(below)* of suction and discharge pipes are operated by electric motors equipped with control units. All control units are connected to two central control panels.

For loading the hoppers with dredged sand, the ship is equipped with two inclosed flumes, one on each side under the deck. A classifying screen is provided at each hatch along the flume for loading the required sizes of material into the hopper. Oversize material is rejected by the classifying screen and sent overboard. For a filling job, such as that at Lincoln Park, it is unnecessary to reject any material in this way. As the hopper fills, the classifying screen gate is closed to shut off the flow.

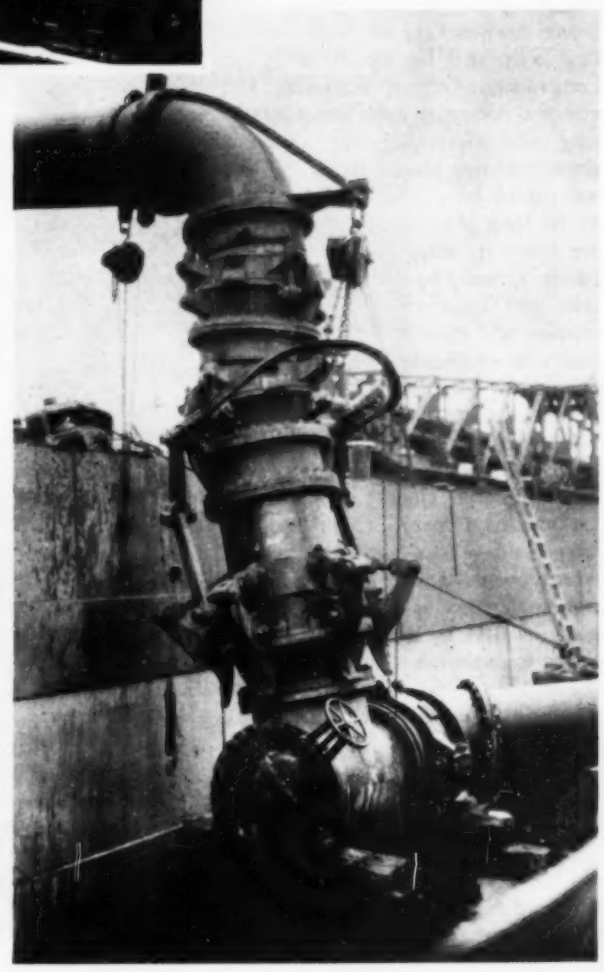
For unloading wet cargo, the cargo hold is equipped with eight vertical wells located along the center line bulkhead and projecting into the hoppers on both sides. When a cargo of sand is to be unloaded wet, nozzles direct pressure jets of water against the surface of the sand and wash the material into these wells. Each well has a vertical row of intakes gates controlled from the deck. Starting at the top, these gates are opened one after another as the cargo of sand is washed out of the hoppers.

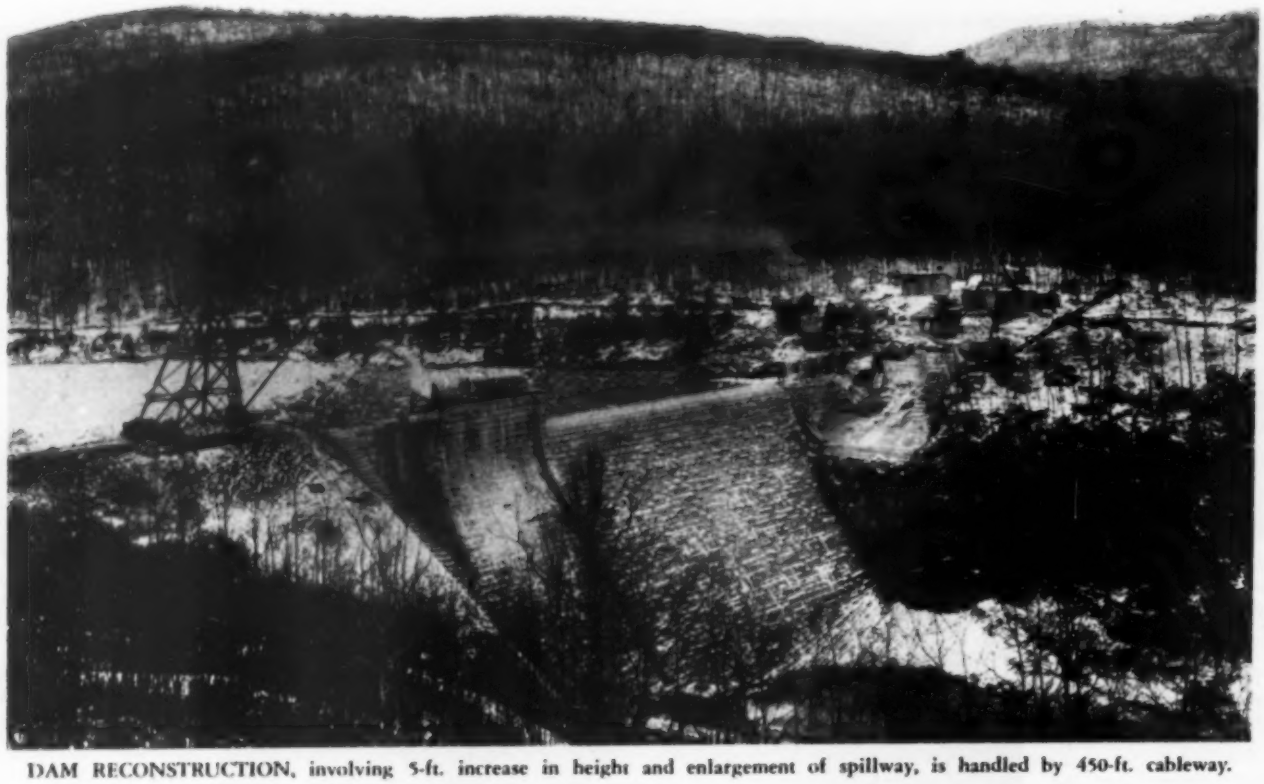
The second and concluding part of this article on the dredged fill extension of Lincoln Park, Chicago, will appear in "Construction Methods" next month.

SHORE CONNECTION has double swivel joint to allow for rolling or pitching motion of ship while discharging cargo. Swivel elbow in discharge line on ship takes care of changing elevation as load lightens.



CENTRAL CONTROL PANEL on deck aft of cargo hold. Any of 27 valves can be opened or closed by push buttons of control panel. Above panel is diagrammatic layout of pipe system with red and green lights at location of each valve to indicate whether valve is closed or open.





DAM RECONSTRUCTION, involving 5-ft. increase in height and enlargement of spillway, is handled by 450-ft. cableway.

ROPE TRAMWAY

Handles Stone for Dam Alteration

CONSTRUCTION and alteration work on the Nesbitt dam of the Scranton-Spring Brook Water Service Co., of Wilkes-Barre, Pa., performed by the B. G. Coon Construction Co., of Kingston, Pa., involved raising an earth breast 275 ft. long and riprapping the upstream slope, removing and replacing the original coping on a stone masonry breast 85 ft. long after raising this part of the dam 5 ft., lengthening the existing 140-ft. spillway by 60 ft. on the west side, and constructing a reinforced-concrete and stone-paved spillway overflow with surrounding masonry wall at this end of the dam. Cost of the improvements was about $50,000.

Nesbitt dam, which is located between Moosic and Daleville, serves upper Luzerne County and part of Lackawanna County. The dam has a large drainage area and is situated in a densely wooded section. Alterations were undertaken as a result of a survey made in 1930 by the State Water and Forest Commission. Besides increasing the capacity of the reservoir, the raised dam and lengthened spillway provide greater safety in catching and passing floods. Water passing over the spillway now drops to a depth of more than 100 ft.

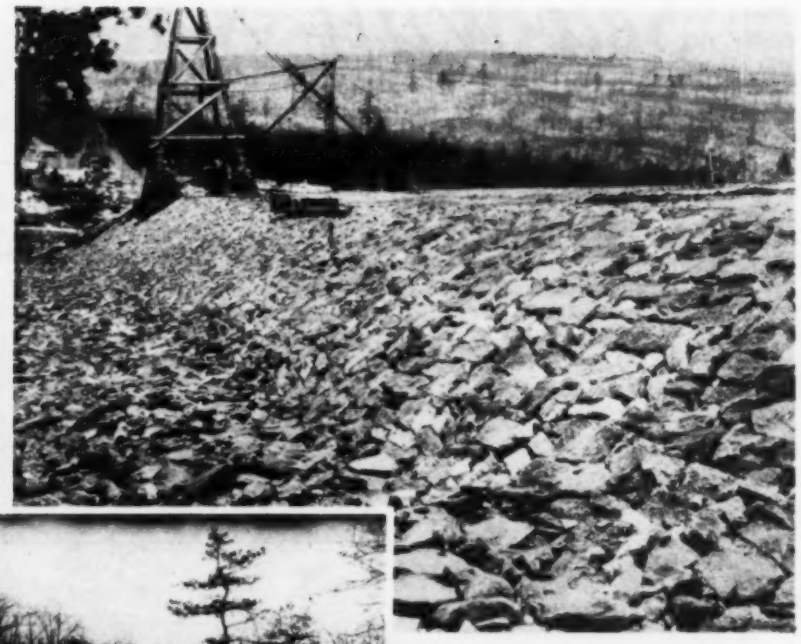
Dimension stone removed from the old breast at the west end of the dam was used as far as possible in the new courses on the east side. New dimension stone, including ashlar, dressed crest stone and coping, was obtained from the same quarry ledge which supplied the original construction in 1901, although a new face was opened, and the stone, a comparatively fine conglomerate, was obtained with very little waste. The stone was hauled about 3 mi. by trucks, the first 2 mi. from the quarry on top of the mountain being over the bed of the old railway used for supply in the original construction.

SPILLWAY CAPACITY is increased by adding 60 ft. to original 140-ft. length of overflow section.

Construction Equipment — At the dam, a Flory cableway of 450-ft. span, powered by a three-drum gasoline hoist, was used to remove and reset the ashlar, crest stone and coping on the dam. A small improvised derrick handled the ashlar and coping required to raise the east wing walls to conform to the steepened embankment slopes; while a Northwest 1-yd. shovel and 55-ft. crane handled the excavation on the west side, the unloading and rehandling of all stone from the quarry which could not be placed at once by the cableway, and the placing of stone for the spillway overflow paving and surrounding wall.

Borrow for raising the embankment on the east side was obtained from that hillside. The comparatively small yardage involved was loaded into 1½-yd. trucks through a grilled trap by teams and scrapers, the grills serving to remove the larger stones. The embankment was placed in air-tamped

EXCAVATION and stone setting for lengthened spillway are handled by crawler crane with 55-ft. boom.



RIPRAP is placed on upstream slope after 275-ft. earth breast of dam has been raised.

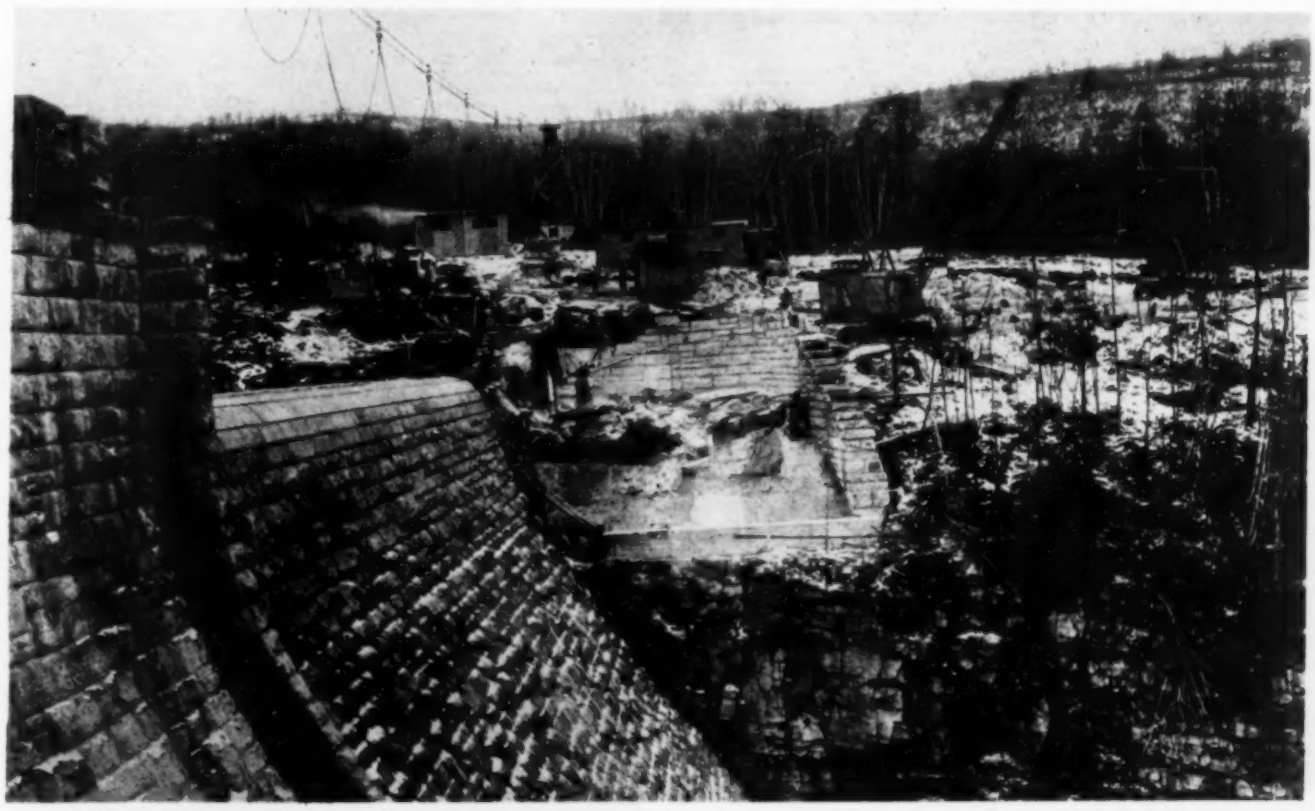
QUARRY, served by 54-ft. boom derrick, provides ashlar and coping stone for raising wing walls of dam and enlarging spillway.

layers on a stepped slope, the air for tamping being supplied by an Ingersoll-Rand 140-cu.ft. compressor. This part of the work was completed first to avoid frost and provide increased height for the east cableway tower. New riprap stone was obtained from the waste piles of the old quarry.

At the quarry, a combination stiff-leg and guy derrick with 54-ft. boom and American hoist handled all stone from one set-up. Practically all stone was quarried with plugs and feathers, less than 100 lb. of black powder being used in 1-in. holes for lifting and starting the larger blocks. A small quantity of dynamite was employed to obtain backing stone toward the end of the job. An Ingersoll-Rand 310-cu.ft. compressor furnished the air for drilling. Some chipping was done by air, but most of it by hand.

Construction was completed less than 4 months after the start of operations. Just 3 months elapsed between the beginning of stonecutting operations and the completion of the dam raising and spillway enlargement.

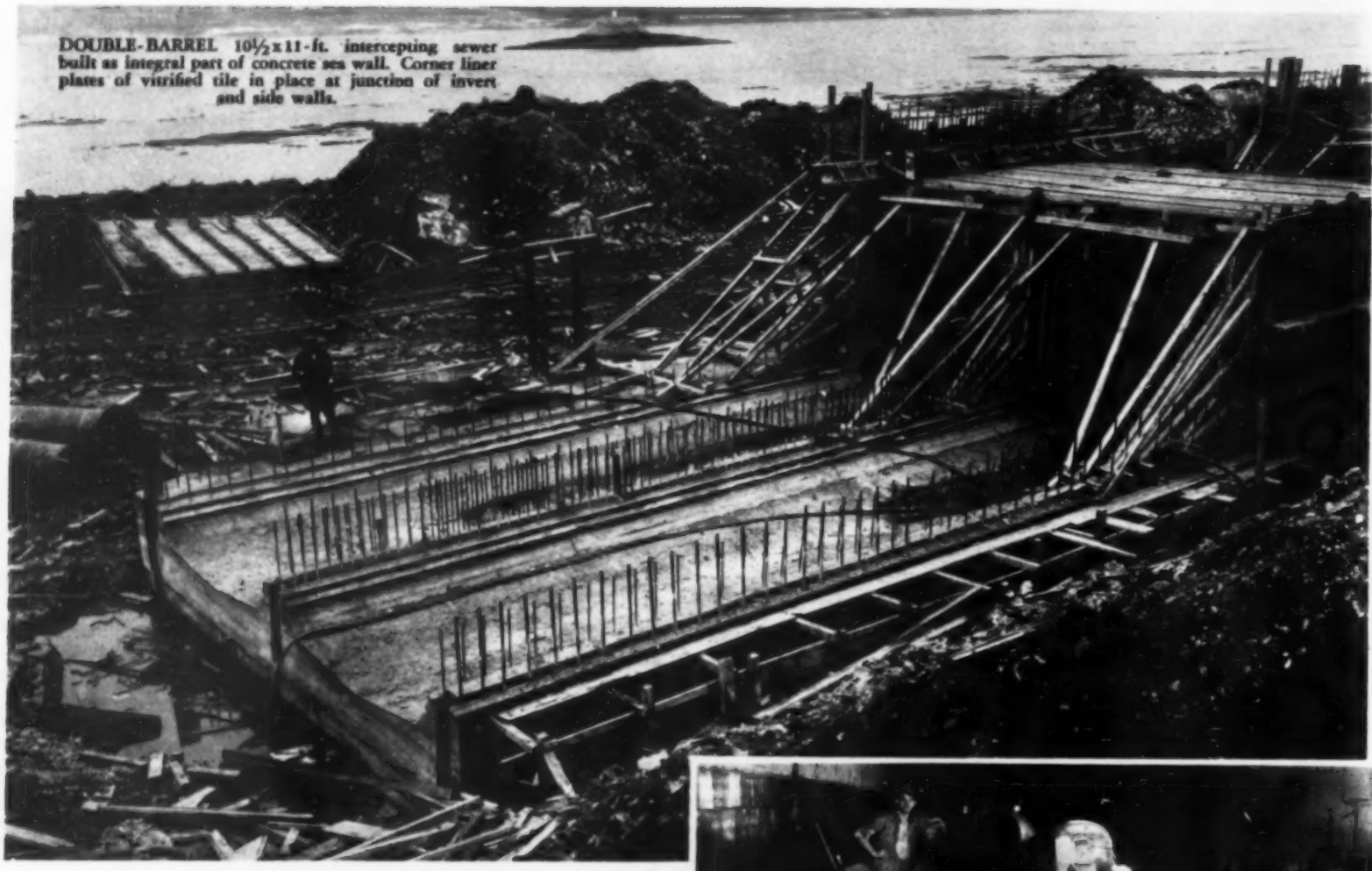
A. Harden Coon, of Kingston, Pa., president and general manager, was in charge of the work for the B. G. Coon Construction Co. DiRienzo Bros., of Scranton, Pa., performed the stonecutting and masonry work for the general contractor. William T. Barnes, chief engineer for the Scranton-Spring Brook Water Service Co., directed operations for the water company, under supervision of Thomas H. Wiggin, chief engineer of the Trojan Enginering Corp., a sub-organization of the Federal Water Service Co. W. R. Bray of Wilkes-Barre, Pa., was resident engineer. Rulison Evans, of Kingston, Pa., is manager of the Scranton-Spring Brook Water Service Co.



WALL FOR ENLARGED SPILLWAY, at right of dam, is built of stone masonry delivered from nearby quarry and set by crawler crane.

Sea-Wall Sewer of Concrete Has

VITRIFIED CLAY LINING



DOUBLE-BARREL 10½x11-ft. intercepting sewer built as integral part of concrete sea wall. Corner liner plates of vitrified tile in place at junction of invert and side walls.

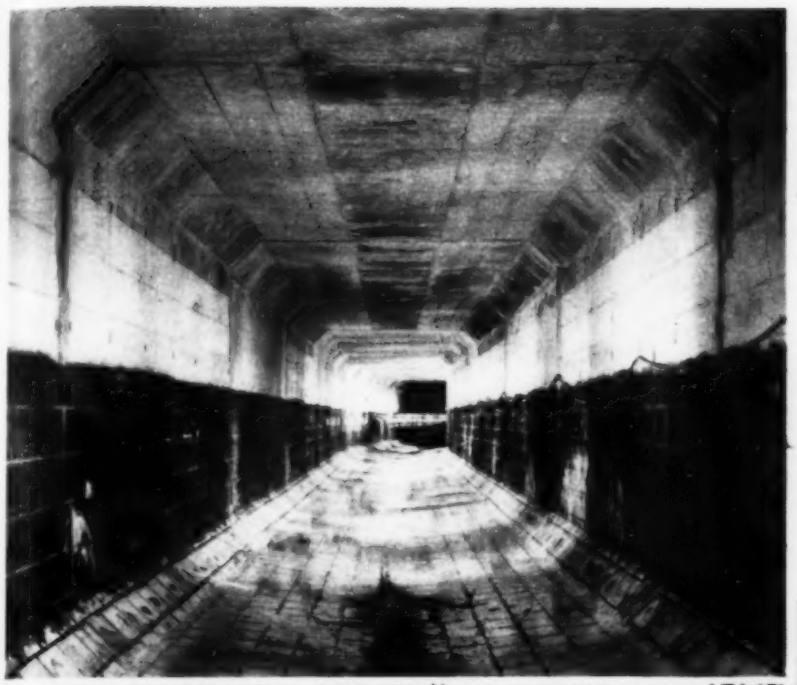
By JAMES F. C. HYDE
Captain, Corps of Engineers, U. S. A.
Rock Island, Ill.

IN THE CONSTRUCTION of Lock and Dam No. 15, Mississippi River, at Rock Island, Ill., it was necessary, to avoid damage to the community by submerging the existing sewer outlets, to provide an intercepting sewer to collect sewage formerly discharged into the river along the Iowa shore. A required elevation of the water surface above the dam would also result in the inundation of valuable land along the shore unless some sort of protection was provided. To overcome these difficulties a sea wall, with an integral intercepting sewer, was included in the contract for the dam.

Design—The interceptor is 22,546 ft. in length. From the outlet, located 138 ft. below the dam, it extends upstream approximately 8,000 ft., consisting of two barrels, each 10 ft. 6 in. in height by 11 ft. in width, constructed integrally with the sea wall. A single barrel of the same size extends upstream an additional 1,790 ft. to the end of the sea wall and then continues upstream in gradually diminishing size to the upper end, where the dimensions are 7 ft. in height by 4 ft. 6 in. in width.

The inverts and side walls, to a height of 5 ft. 8 in. in the barrels constructed integrally with the sea wall, are lined with vitrified clay sewer lining, conforming to the requirements of the A. S. T. M. standard specifications for vitrified clay sewer pipe as regards absorption, glazing, cracks and blisters. Considerable difficulty was experienced in producing liner plates meeting the tolerance of not over ⅛ in. allowed for warp. Tolerances of 1/16 in. in thickness, ⅛ in. in width, ⅛ in. in length were allowed and were met without serious difficulty.

INVERT LINERS *(right)* are embedded in 1 in. of cement mortar after surface of concrete has been thoroughly cleaned.



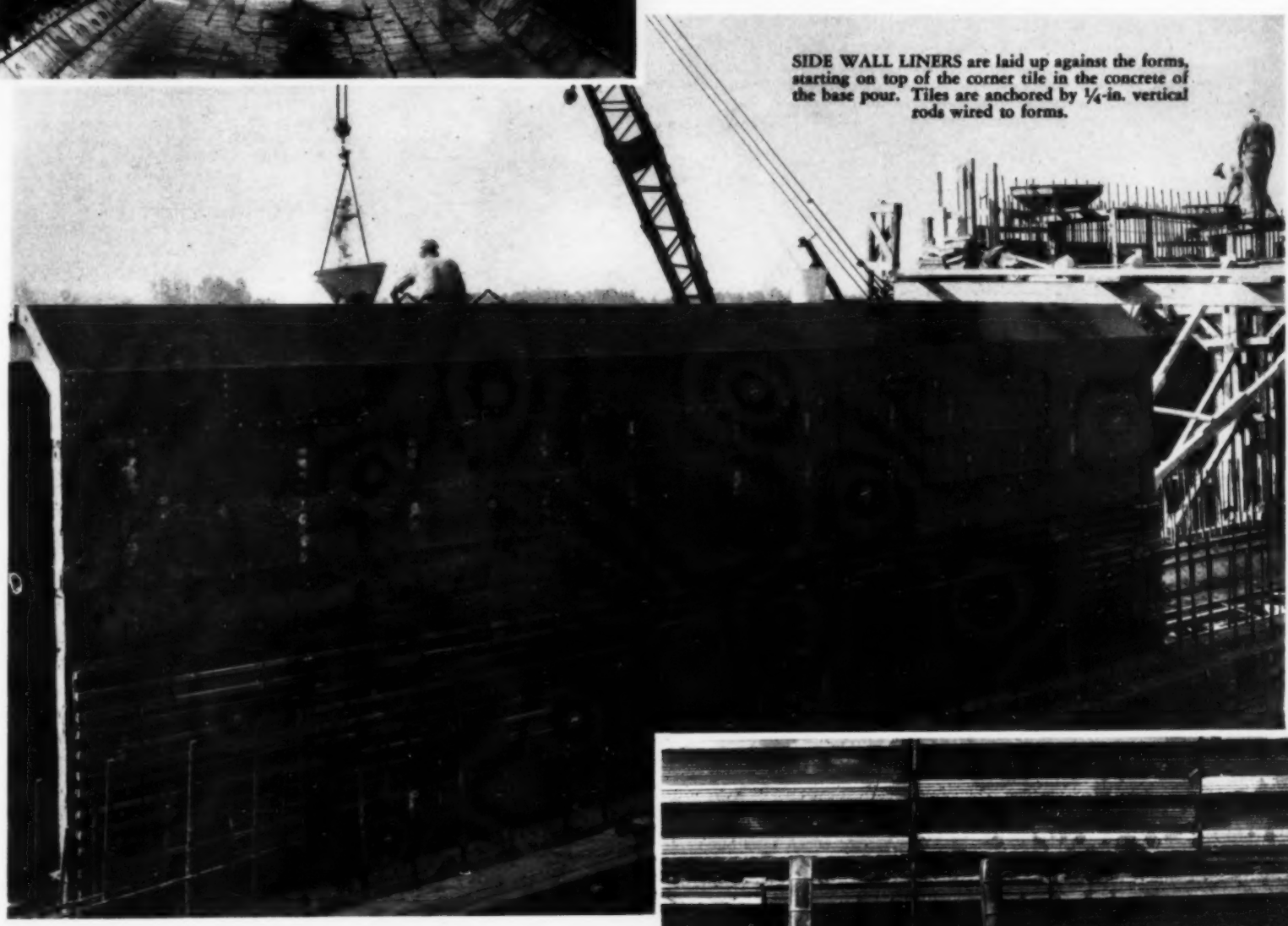
FINISHED INTERIOR *(left)* **of sewer, showing invert and side walls, to height of 5 ft. 8 in., lined with vitrified clay plates.**

and the forms removed, the invert liners were placed. The foundation concrete to receive these liners was first thoroughly cleaned to produce a surface absolutely free from foreign matter. The center row of liners was then placed in cement mortar, approximately 1 in. thick, true to line and grade, after which the other liners were filled in to the side walls.

Sections of liners were removed, after the concrete had completely set up, to determine the character and effectiveness of the bonding, which proved to be entirely satisfactory. The side wall liners could only be removed by chipping them out in small pieces.

A crew of from 6 to 8 men would lay floor liners for approximately 180 lin. ft. of single barrel sewer in an 8-hour shift. Approximately 359,800 sq.ft. of tile liners were placed in the floors and side walls of the sewer barrels integral with the sea wall. The contract unit price for furnishing and placing the tile liners was 17c. per square foot of liner in place.

Personnel—The construction of the interceptor and placing of tile liners was done by S. A. Healy, contractor, of Detroit, Mich., under his general contract for construction of the dam, sea wall and intercepting sewer. For the U. S. Engineer office at Rock Island, Ill., Lieut.-Col. Glen E. Edgerton is district engineer.



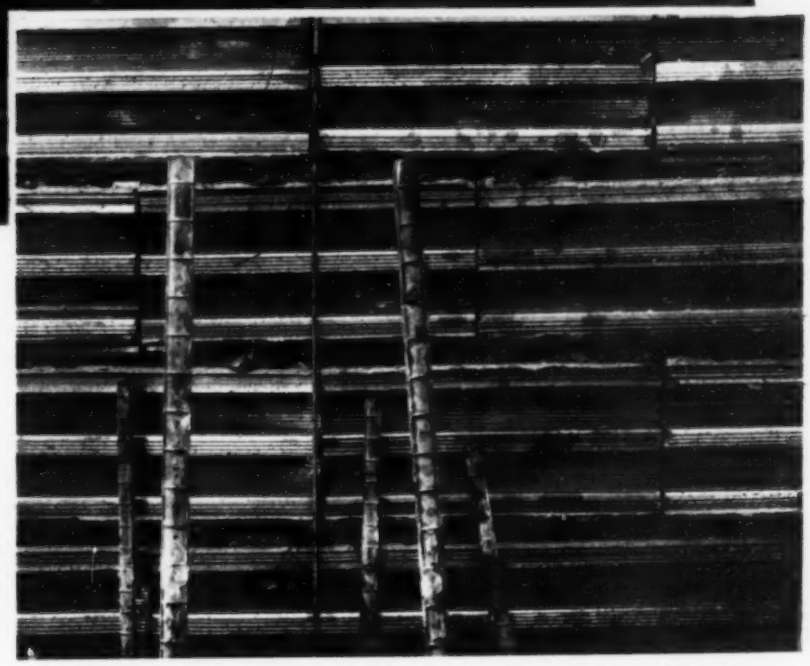
SIDE WALL LINERS are laid up against the forms, starting on top of the corner tile in the concrete of the base pour. Tiles are anchored by ¼-in. vertical rods wired to forms.

The standard liner plates were 9¼ x2x17⅞ in. Half-length pieces were used to reduce the cutting of the standard length plates at construction joints. Special corner pieces were used at all corners. Each liner plate was provided with three dove-tailed bonding keys 1 in. deep by 1⅜ in. wide at the bottom edge. Corner liners were provided with 4⅛-in. holes to facilitate attaching to the side forms. The liners were manufactured by the Laclede-Christy Co., of St. Louis, Mo.

Construction—Little difficulty was experienced in placing the liners after a satisfactory method was worked out. The foundation concrete was poured with the corner tile, at the junction of the sloping bottom with the vertical side wall, attached to the form, thus providing a ground or working line for aligning the side wall liners and invert liners.

After the interior side wall forms were in place, the side wall liners were laid up against the forms, starting on top of the corner tile already embedded in the concrete of the base pour, embedding the edge of each liner in cement mortar. The tiles were anchored to the forms by ¼-in. vertical rods at the backs of the tiles wired to the insides of the forms.

After the tunnels were completed



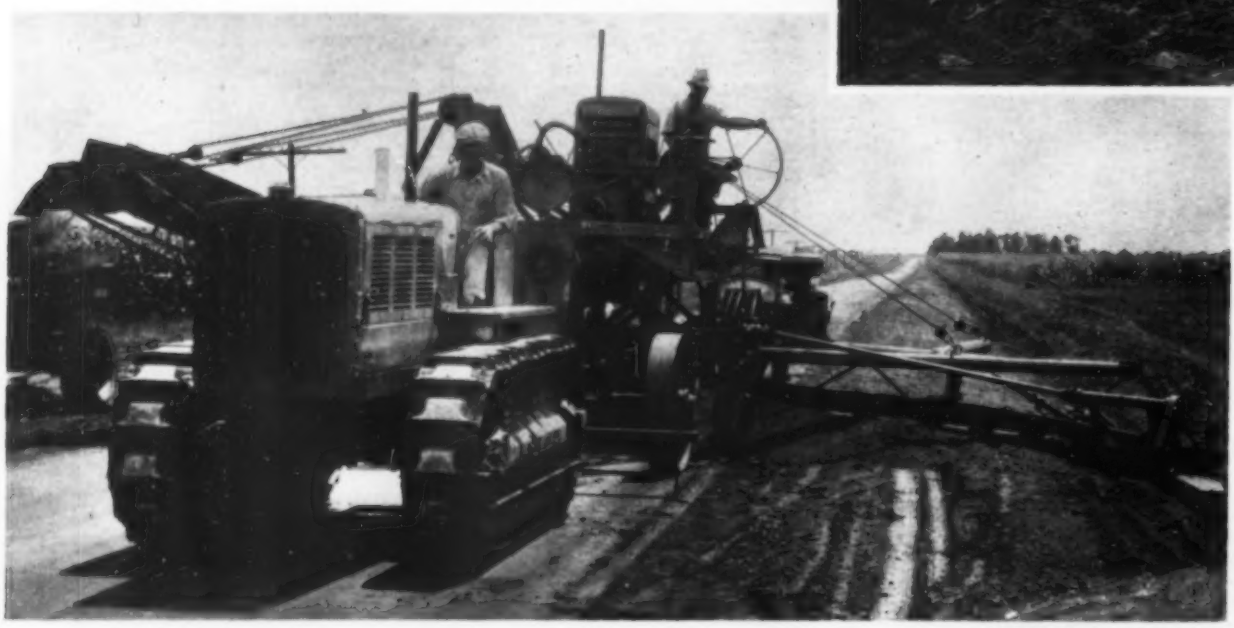
BONDING KEYS, 1 in. deep and 1⅜ in. wide form grooved back for anchoring each tile to concrete side wall of sewer.

Getting Down to

DETAILS

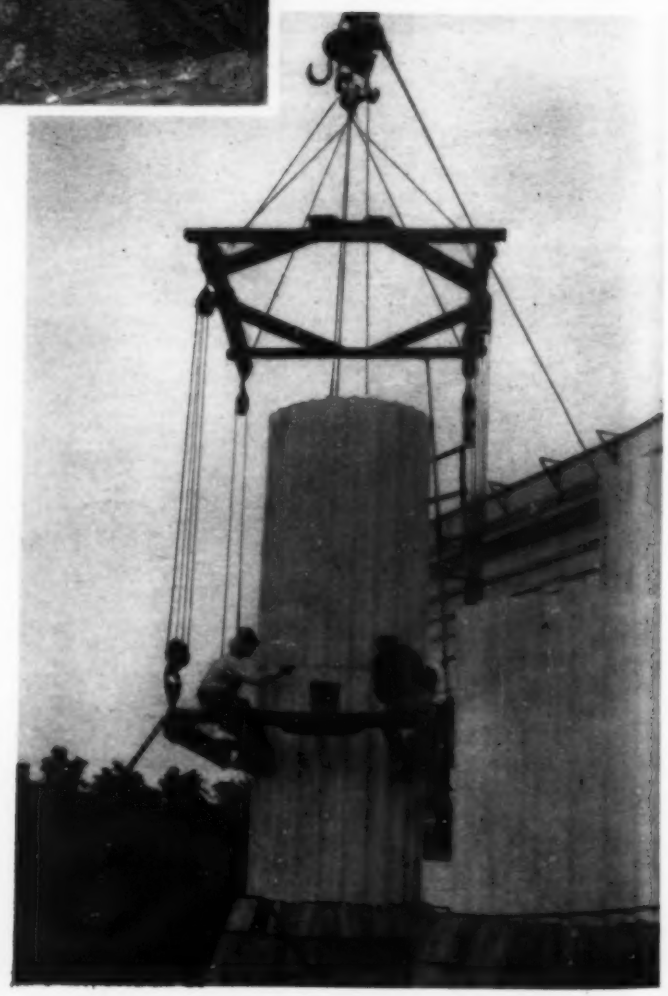
Close-up Shots of
Job Methods and Equipment

KICKOUT PAN, consisting of sliding steel sheet attached by two chains to front end of body, insures complete discharge of material, even though sticky, from Koehring wheel dumptor. Action of pan is automatic as body is raised to dumping position. Pan breaks suction between load of material and bottom of body.



ROAD SHOULDERING ATTACHMENT on Austin-Western elevating grader is equipped with screw conveyor which moves earth loosened by blade to elevator belt from which it discharges into trucks.

LEVEE ENLARGEMENT on Puyallup River in Washington, requiring 360,000 cu. yd. of material from streambed to increase embankment width from 30 to 62 ft., is handled by Sauerman 2-yd. slackline cableway bucket operated from movable tower. Excavating bucket delivers into receiving hopper from which material is raised to rubber-lined distributing chute. Contractor, Hart Construction Co., Inc., of Tacoma, Wash.

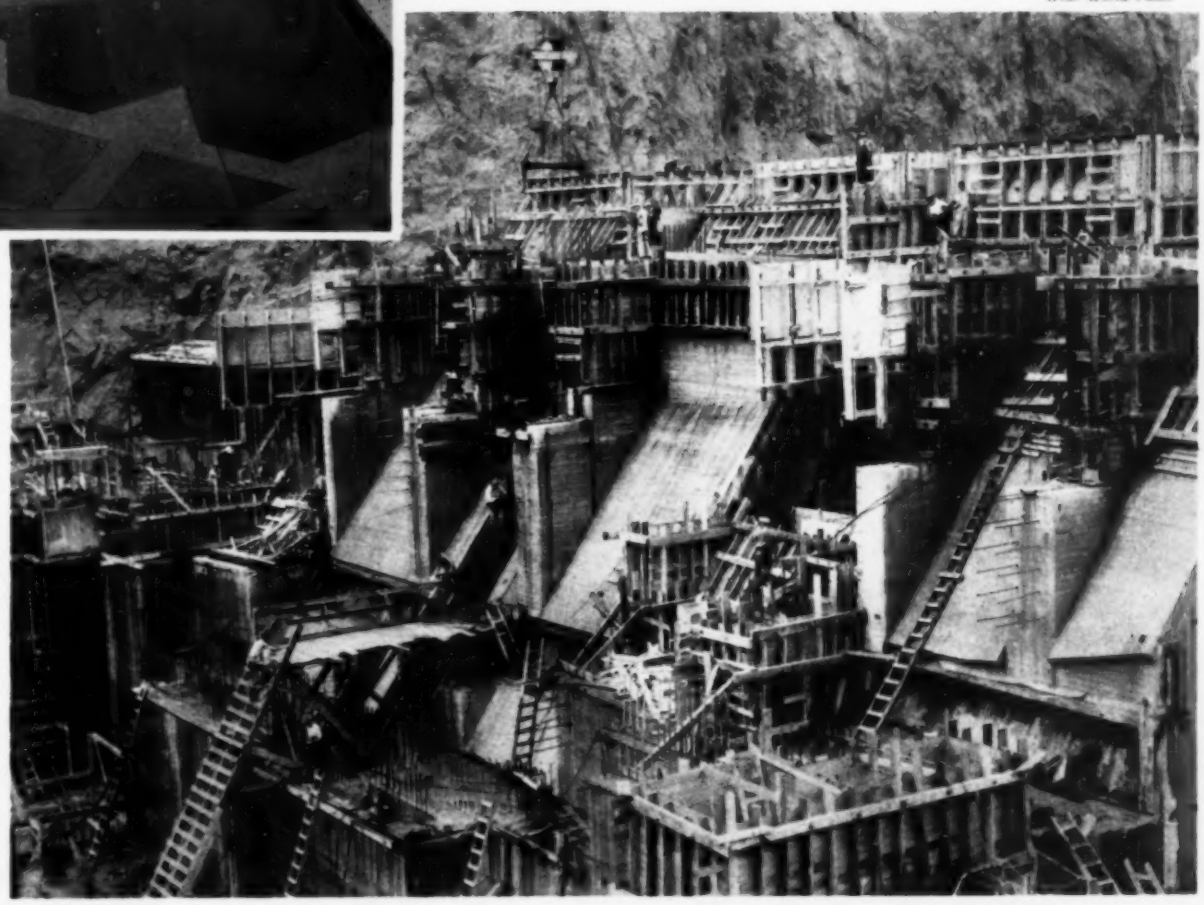


SPECIAL SCAFFOLD aids setting of drums for marble columns of $9,000,000 U. S. Supreme Court Building, Washington, D. C. Scaffold is lifted with stone when latter is raised by derrick so that when marble is lowered to place frame on which men work is within easy reach of joint. General contractor, George A. Fuller Co.

TERRAZZO ESPLANADE forms colorful approach to Adler Planetarium at Century of Progress Exposition, Chicago. Design employing Atlas white portland cement, blended in nearly fifty color tones, symbolizes march of months through year, with panels representing January by a snow crystal, February by tree with snow-covered branches, etc. Color of terrazzo panels is accentuated by shallow sheet of water flowing over them. Esplanade was installed by National Terrazzo and Mosaic Association, Inc.

IMPROVED FLOAT for concrete pavement, designed by B. R. Smith, of Indiana Highway Department, is of galvanized metal with replaceable redwood finishing boards. "Gable-roof" design insures stiffness and retention of true surface.

Wide World Photo



FORM DETAILS for blocks of concrete which Six Companies Inc. are pouring to form base of 730-ft. high Boulder Dam for U. S. Reclamation Service on Colorado River. Concrete in 8-cu. yd. buckets is delivered by a number of high line cableways spanning the deep canyon. The concrete blocks, varying in plan dimensions from about 50x50 ft. on the upstream side to 25x25 ft. on the downstream side, are being concreted in lifts not exceeding 5 ft. in 72 hr. Built in to the concrete blocks is a system of piping carrying chilled water to dissipate the heat of the cement during the setting period.

CABLE-LAYING RIG *(left)* on crawler-mounted frame, hauled by Caterpillar tractor, places armored underground line 170 mi. long between Joplin and Kansas City, Mo., for Southwestern Bell Telephone Co. Furrow dug by tractor-hauled rooter receives cable unwound from reel.

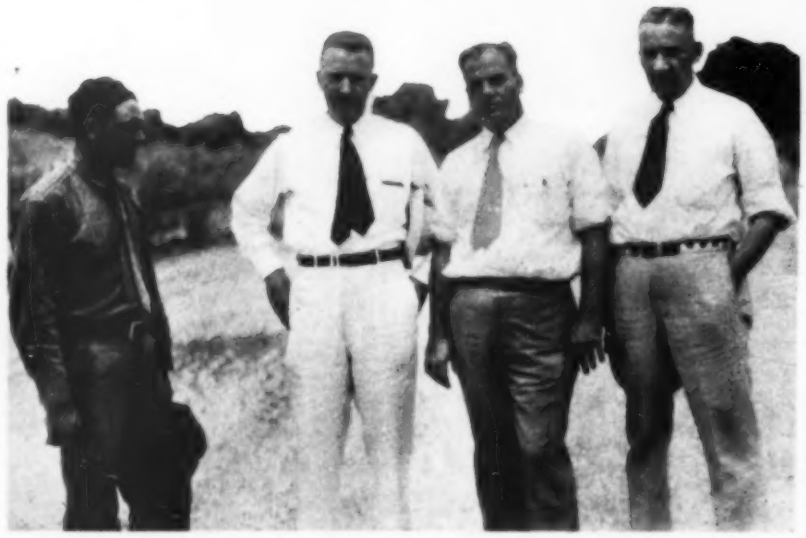
A Year's Experience in North Carolina With 46,000 Miles of

Local Roads Under State Control

FLEXIBLE METHODS, policies and organization have been necessary in solving the problems that arose when on July 1, 1931, the 100 counties in North Carolina turned the construction and maintenance of all their local roads, totalling more than 46,000 miles, over to the state highway commission. Results for the first twelve months under the requirements of the legislative act that occasioned this radical change show that the plan of centralized control of all public highways of the state offers large opportunities to save money. During this period also there has been great improvement in the condition of the roads formerly maintained by the counties.

All that has been accomplished is due to better methods and more economical use of equipment than was possible in all except a few of the more populous counties. In the latter exceptions the roads formerly in charge of local organizations have been kept at least up to the standards previously set for them.

Of the 46,000 miles of local roads in North Carolina only a small fraction carry any considerable volume of traffic. During the first twelve months of state control about 5,200 miles of these more important county roads were regraded and then sufficiently surfaced to provide year-round service. The remaining mileage has been variously bettered, depending on the importance of each particular section. The general policy of the commission has been to get the maximum possible number of rural inhabitants dependent on purely local roads permanently out of the mud.



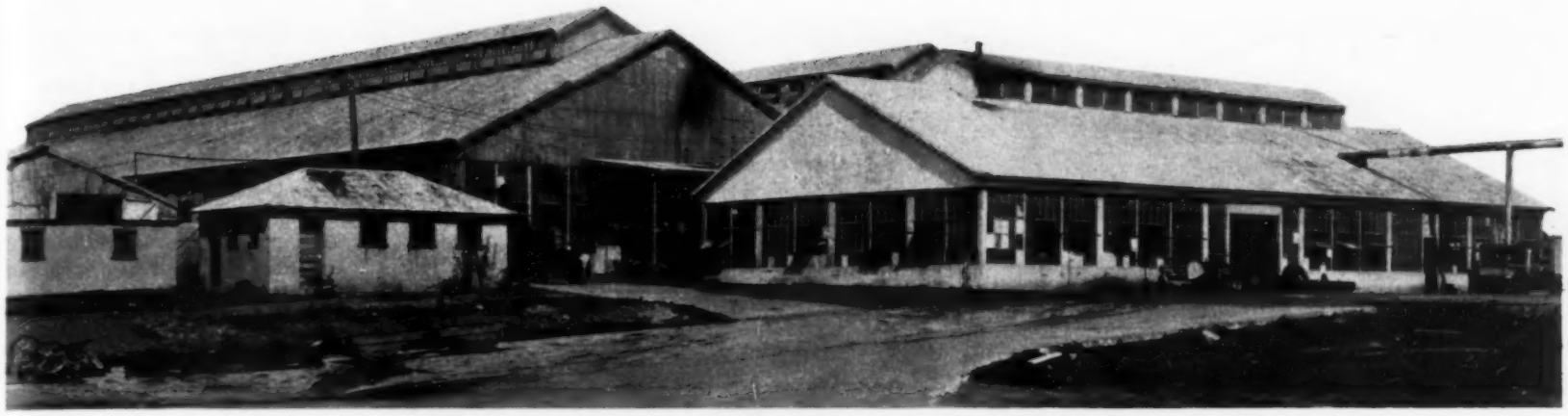
HIGHWAY DEPARTMENT PERSONNEL. *(Right to left)* L. R. Ames, state highway engineer; D. M. Rea, division engineer; B. W. Davis, equipment engineer; R. G. Gandy, foreman.

Under the act of the legislature the state highway commission was required to spend annually a minimum of $6,000,000 on local roads. This sum compares with about $8,500,000 previously spent by the counties. During the first twelve months of centralized control the state highway commission actually spent in round figures $6,130,000. A considerable part of this total went into betterment that was heavy enough to be practically reconstruction and will not again be involved on the roads thus improved. An exceptionally heavy charge for equipment also had to be absorbed, due to various conditions that are not expected to recur.

Organization and Equipment—Under the scheme of organization that existed prior to taking over the great mileage of local roads the state highway system of 10,000 miles was handled by nine districts with an engineer in charge of all maintenance work in each district. Field work was done

ONE-MAN MOTOR GRADER is employed extensively in North Carolina for light regrading and maintenance work.

LIGHT COAT OF SAND is spread on clay subgrade by end-dump motor truck with tailgate adjusted for correct rate of discharge.



GENERAL SHOPS of North Carolina Highway Department where regular maintenance operations and major repairs on trucks and other mechanical equipment are handled.

with crews of two or three men each handling 30 to 45 miles of highway. When responsibility for the local roads was assumed, five districts were created in each of five divisions substituted for the original nine with an engineer in charge of each under the division engineer. The maintenance crews, or section men, on the state highways had their mileage increased 20 to 30 per cent to absorb part of the local road work. In handling the remainder of the local roads additional crews were added, each crew of two or three men being responsible for from 75 to 110 miles, depending on local conditions and traffic.

On the local roads the policy is to provide each crew with sufficient maintenance equipment so that the entire mileage for which the crew is responsible can be scraped and dragged within three to four days following a period of wet weather. One-man motor graders, dump trucks big enough to pull road drags and light crawler tractors handling 8 to 10-ft. blade machines are chiefly used for maintenance work. The tendency is toward fairly heavy one-man motor graders, but on practically all sections at least one dump truck is necessary. The size of truck used depends on various conditions. For ordinary hauling 1½-ton trucks are extensively employed. Where the truck must do considerable pulling of drags 2½ or 3-ton trucks are provided.

For the extensive mileage of the principal county roads that have been regraded heavy crawler tractors and large blade machines have been found effective. With the soils found in much of the state these outfits can ditch and shape up for surfacing at a low cost per mile.

Materials—Soil, climatic and traffic conditions vary so widely over the state that various materials have been used in surfacing the principal local roads. On account of the limited funds available it has been necessary to use such sand, top-soil, creek gravel and rock as could be obtained close to the job. Experience has shown that on a subgrade that has been well drained and properly shaped a surprisingly thin layer of such local materials provides an all-weather surface for light local traffic. By strengthening weak spots under maintenance such surfacing is kept up at small cost.

Various expedients have been adopted in claiming and transporting the local surfacing materials. For example, through the central part of the state, where excellent sand occurs in practically all the creeks and rivers, portable centrifugal pumps are used extensively to excavate and pile the sand on the bank. These outfits, in either 4 or 6-in. sizes, are each mounted on a homemade two-wheel trailer built from used truck parts. Each outfit is belt driven by a small tractor, which also moves the outfit quickly from place to place.

This combination can easily be taken to isolated spots on streams. It is practical to use these outfits on comparatively small deposits, since they can be set up and running in not more than half an hour. The pump carriage is simply run down the creek bank into the edge of the water with the tractor on the bank above. A 20 to 30-ft. suction hose, handled submerged in the deposit of material by two men, will reach quickly a considerable amount of material at each set up. The pump discharges into a pile far enough back from the edge of the bank so that the water drains out and leaves all the sand ready for transport to the job.

WAGON TRAIN, hauled by tractor, distributes top soil.

HEAVY OUTFIT, comprising tractor and blade grader, used to shape local roads.

From the piles of sand excavated by these pumping outfits loading is usually done by hand into dump trucks for delivery to place on the road. When the truck arrives at the point where sanding is in progress the tail-gate of the body is fastened with an opening wide enough to spread the right depth of sand as the truck moves ahead.

On a subgrade which has been well shaped by a blade machine no further spreading of sand is required. The regular maintenance crew keeps the sand well distributed until traffic sets into the sub-grade.

Several ¾-yd. crawler power shovels, equipped with clamshell buckets and booms, also are used in excavating sand and gravel from small local stream deposits. A few stationary rock-crushing plants, previously installed by the counties, were taken over and are operated by the state. Much of the local road resurfacing in the mountains, which cover the western part of the

state, is done with the output from small portable crushers that are moved along the road.

In some cases local rock picked up on or close to the job is crushed in these portable outfits. To a large extent the latter reduce over-size stones in the run of the deposit of creek gravel previously spread on the road. These over-size pieces are piled up along both edges of the surface by hand.

As the portable crusher outfit comes along the windrows of over-size rock are fed into it by hand. The output is deposited directly on the road and spread by hand to top dress the previous coat of gravel. With a comparatively thin layer of material a surface is thus obtained at a low cost per mile that stands well under local traffic.

FROM STREAM BED crawler crane with clamshell bucket reclaims sand and gravel for road surfacing.

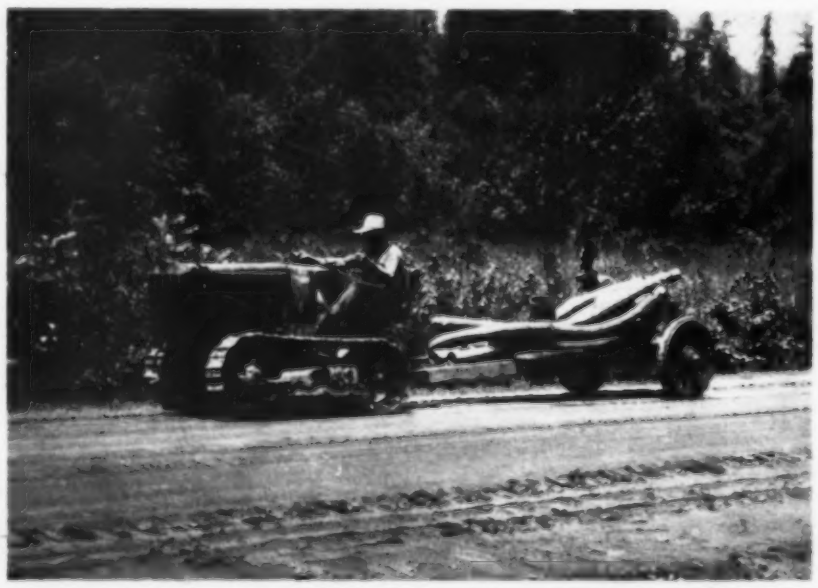
PORTABLE CENTRIFUGAL PUMP RIG, driven by belt from tractor, dredges sand and gravel from river for use in surfacing local roads.

Each job of regrading and surfacing on the most important local roads is worked out according to local conditions. Practically no surfacing material is imported for such jobs. The depth of material used is varied according to the character of the surface and the type of sub-grade material involved. As a general proposition specifications are lacking, the rule being that each man must get the best possible job within the low limits of the money available.

Plant Service and Repair—Servicing and upkeep of the extensive plant and equipment required by the state highway commission to maintain a total of nearly 55,000 miles of roads and highways are handled with comparatively limited shop facilities. All told, the state has approximately $3,500,000, replacement value, of highway equipment. Practically all the upkeep work on this equipment is done in garages and shops state owned and operated.

All ordinary servicing and minor repairs are handled in the garage and shop provided for each of the 25 districts into which the state is divided. More important repairs and replacements are usually made in the larger division shops. Major work is handled in an extensive central plant operated at state headquarters, although some major work is done in division shops at a long distance from headquarters.

Parts for Fords, Chevrolets and similar equipment are obtained largely from local dealers. For all other units, however, stocks of spares and parts are maintained in the division shops, unless local representatives of the manufacturers carry them. Ample quantities of supplies to keep all equipment in service also are well distributed over the state.



EN ROUTE. Portable centrifugal pump unit for reclaiming river sand on way from one set-up to another.

Standards have been set up for oil changes, greasing and similar servicing for which the field crews are held responsible. A mechanical foreman in each division, who travels most of the time, constantly checks on these features. He also supervises all repair work on the equipment in his division. At fixed intervals, or after a certain amount of use or mileage, equipment is thoroughly inspected in a shop to make sure that the local men have not overlooked any difficulties that would force the equipment out of service.

E. B. Jeffress is chairman of the North Carolina State Highway Commission. L. R. Ames, state highway engineer during the reorganization of the work, has been superseded by John D. Waldrop.

SAND BLAST

Countersinks Bronze Letters in Granite

AN EXAMPLE of the accurate and delicate work which can be performed by sand-blasting machines in cutting designs or letters in granite is indicated by the accompanying series of step-by-step photographs illustrating the operations of H. Cardin at the entrances of the Dime Savings Bank, Brooklyn, N. Y., for which the William Kennedy Construction Co. was general contractor. Mr. Cardin's agreement with James McLaren & Sons, Inc., subcontractor for the stone work, stipulated that he should cut grooves accurately according to blueprints which were furnished him and should install in the grooves bronze letters 1/4 in. deep and 2 1/2 in. high. To permit insertion of the bronze letters, it was necessary that the countersunk channels should be rectangular in shape, i.e., that the sides of the grooves should be at right angles with the surface of the granite. This requirement called for special methods which were applied and successfully executed in the manner depicted by the photographs. Halsey, McCormack & Helmer, Inc., of New York, was architect of the Dime Savings Bank.

1 SITE OF SAND-BLASTING OPERATION is inclosed by canvas tarpaulins on wood frame to protect passersby from flying sand particles and to shield granite from hot sun. Entire sand-blasting outfit is portable and is transported by truck at left which carries Schramm 72-cu.ft. air compressor. Rubber hose 1/2 in. in diameter conducts air from compressor to sand-blasting machine.

3 SAND-BLASTING MACHINE forces stream of hard silica sand through 3/16-in.-diameter cast-iron nozzle which directs stream against glue stencil sheet and exposed granite surfaces. Tank of Ruemelin, Jr., machine is loaded with 200 lb. of Ottawa silica sand, sufficient for 1 to 1 1/4 hr. continuous operation. Air pressure at machine is 80 to 85 lb. per square inch. Nozzle is held 12 to 16 in. from work. Helmet of aluminum and canvas protects operator's head and face. Small rubber tube connected to helmet from sand-blasting machine supplies stream of air at low pressure for cooling. Old tire tubes make satisfactory arm protectors. In warm weather, wood staging is covered with canvas to protect work from sun's rays, as heat causes glue sheet to become sticky.

4 THREE STAGES OF WORK in sand-blasting granite for installation of bronze letters. First step is illustrated by three lower lines of five-line inscription. These letters have been outlined on glue sheet but have not been sand-blasted. Second line of inscription shows results of second step of operation. Edges of these letters have been sand-blasted to depth of 1/4 in. Word "THE" in top line shows third stage of work, with sand-blasting completed and bronze *T* temporarily installed in position. Bars of letters vary in width from 1/4 to 1/8 in., and points at tails of letters taper to 1/32 in., making it necessary to closely control sand-blasting work and to hold it within accurate limits.

2 GLUE STENCIL SHEET is applied to face of granite block. Resilience of protective sheet deflects sand particles except where openings are cut in sheet to permit penetration of sand into granite. Outlines of letters are traced with soft pencil on blueprint provided for this work by architect, and these outlines are transferred to glue-composition sheet.

In cutting rectangular grooves for installation of bronze letters it is necessary first to cut edges of slots and later to take out center core of each groove. If operator followed usual procedure employed in cutting inscriptions and sand-blasted full width of slot in one operation, resulting groove would be convex in shape. To cut rectangular channels, operator outlines letters on prints with double lines, closely spaced, and transfers double lines to glue stencil sheet.

Narrow width of 1/16 in. or less between double lines is cut out first with sharp home-made tool, consisting of safety-razor blade gripped in end of short stick about shape and size of pencil. This operation exposes granite surface along edges of letters.

Helps to Successful Contracting

Thirteenth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

XIII—Night Work

By HARRY O. LOCHER
Contractor, New York

WITH THE HIGHLY efficient, modern electric floodlights and other types of lights, all of which can be used so economically, there is no excuse for night construction workers being handicapped and placed in danger on account of poor lighting. Spending money for lighting is one sure way to save much more money in other directions. Such spending is a profitable investment, not an unnecessary expense. There is neither sense nor economy in snapping off lights here and there, or in doing without lights entirely in certain places to effect an imaginary saving, small at most, when, by so doing, the amount "saved" is lost over and over again in working efficiency and in accidents.

"Unless careful plans and preparations for night work are made during the day, the night shift begins with a handicap."

Don't Skimp on Illumination—"To turn out as much work at night as during the day, you must make night work as nearly like day work as possible," a very capable superintendent often said. The thing most necessary to bring this condition about is proper light and plenty of it. The splendid modern floodlights come as near to making daylight at night as is possible. Lights should shine on everybody possible so that they—and you—can see what they are doing.

Lighting systems should be as simple and rugged as possible, consistent with efficiency. On small or medium-sized jobs experts are not always available to take care of generator troubles. On such work a system that a "handy man" can take care of is the type to have. On jobs large enough to justify it, of course, there will be capable electricians. We are considering light generated on the work, and on machines which have their own lighting plants. The purchase of lighting apparatus and the proper placing of lights on the work are things of prime importance, and not a matter of buying just anything and then thinking that men can produce.

Cooperation Between Shifts—After getting the proper equipment, and then properly placing ample lights and seeing that they are well looked after, the next most important thing to bring out efficiency from the night shift is the helpful cooperation of the day shift. Unless careful plans and preparations for night work are made during the day, the night shift begins with a handicap. On a well-managed job the man in charge of night work should meet the day man at least 30 min. before the day shift stops work. What had occurred during the day which would affect night work could be explained and discussed. Things which the day crew had especially done to help the night men could be made known. Anything of an unusual nature that might be expected could be told about. Any changes in conditions or location of equipment could be brought to the night man's attention.

For efficiency and best results possible from night work there should be genuine cooperation between the day and night crews. Sometimes this is difficult to accomplish, sometimes impossible. When responsible day and night men cannot be made to cooperate they are obviously not interested in their work nor their employer, but only in their petty selves. It's time to clean house. There is no better evidence of whole hearted interest and real intelligence than a genuine cooperative spirit.

Passing the Buck—For failure in any direction one of the time-honored excuses of night men has been what the day shift neglected to do. "We would have come through in splendid shape," says the night man, "but the day shift left things all balled up and it took us most of the night to get straightened out."

A day superintendent, returning to the job at about 10 p.m. on the first shift of night work, found one of the shovels idle and in darkness. Inquiry revealed that the day man who had been assigned to get out and make ready the carbide lights, which had not been used for months, had fallen down. He had done everything but the most important thing—testing the lights. On account of this carelessness and lack of attention to detail eight or ten men were fumbling around in the dark trying to get light, and a 2-yd. shovel stood idle and popping off—costing money—all because the small holes in the burner tips of the carbide lights had not been cleaned out. A few inches of wire of the right size and a few minutes would have saved 30 min. time for this crew. Such things multiplied total a large amount of money in a month's time. They may easily be the difference between a satisfactory profit and a disappointing loss.

"Cooperation between day and night shifts must not be taken for granted—it must be skillfully and tactfully cultivated."

Another day superintendent, returning to the work at night, found a crew hastily sawing up some new 12x12's for blocking with which to build a necessary crib. Foresight would have shown that the night shift would reach this work. Short and waste blocking, which was scattered over the job in abundance, should have been hauled during the day to the site of the crib and been ready for use, saving new timber and valuable time.

On a heavy earth and rock cut, which was being taken out by a 4-yd. dragline, the night crew was not doing the amount of work it should have produced. Inquiry revealed that the night operator thought he was handicapped by the day operator who started his new cuts so as to give himself better and closer digging on his shift. After talking the situation over with both operators the superintendent decided on a point for starting all cuts which would work out best as a whole. The bickering ceased, cooperation began and the yardage dug materially increased. Results: No more excessive costs, no more excuses, more yardage and increased estimates. Removing opportunities for excuses and placing men on an equal basis puts them on their mettle. They have to come through with results or admit inability to handle the job.

Cooperation between day and night shifts must not be assumed or taken for granted—it must be skillfully and tactfully cultivated. Some of the very best men will not fully cooperate voluntarily, but when they are shown, in the proper way, the vital importance of it, they most always fall into line

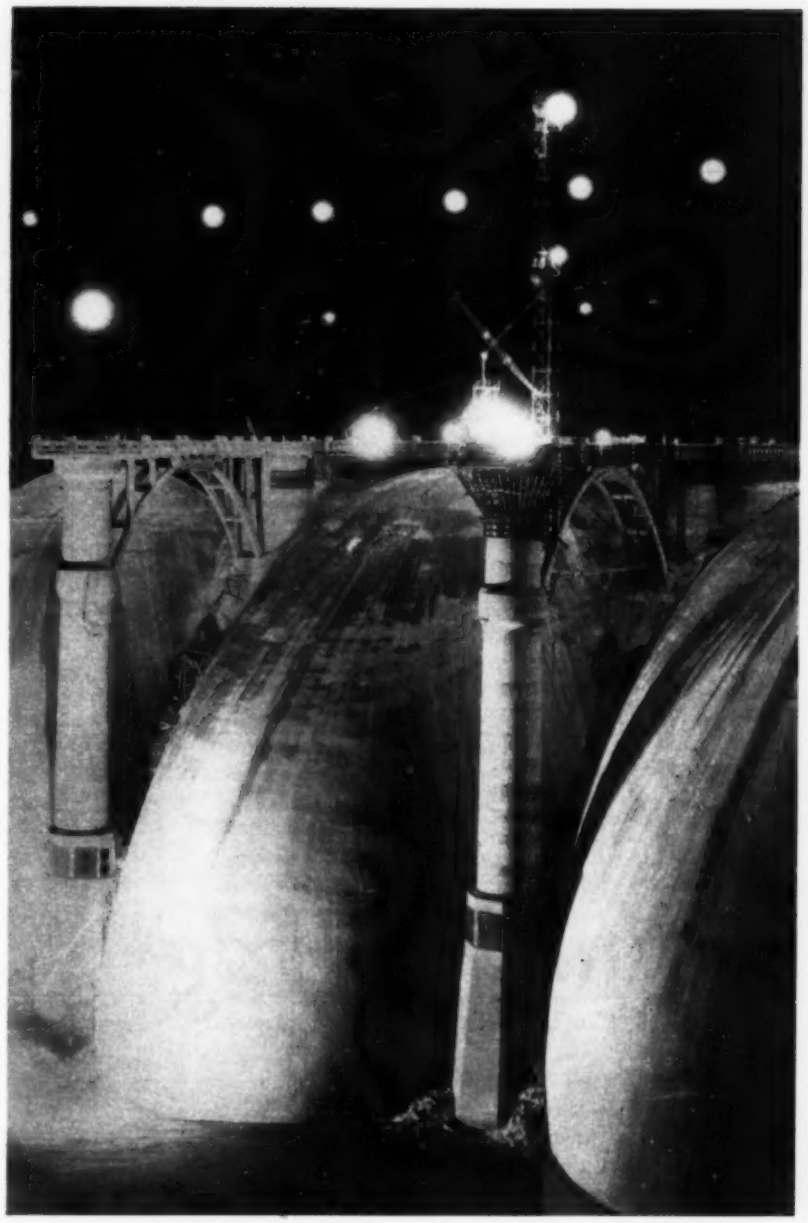
provided that they are really good men and are working under real leadership. If you cannot get cooperation from certain men, replace them with others who will cooperate—you cannot afford not to. Envy, jealousy and non-cooperation are rank poison, and, believe it or not, they have put many jobs in the red that should have earned a profit. One of the places where this great danger usually lurks is between day and night shifts. Keep a keen eye on this spot.

Complaints—Night foremen complain that the day men skim the job and leave them the clean-up end of it (just as important as the skimming) and that they don't have a fair show. Night operators complain of the same things: Their machines are whining for oil when they come on and they can't get started right. Night firemen say they find a bum fire and that it takes two hours to clean it and get it right. Night drillers have difficulty finding enough sharp steel, so they say. When the night men reach the dump things are "all shot," and so on, *ad infinitum*. Mostly excuses or lack of cooperation. The kind of superintendent described in the fifth article of this series "Choosing an Organization", (*Construction Methods*, February, 1933) can sense these things a mile off and kill them by one means or another, before they have reached harmful—costly—size. Let no contractor or superintendent lull himself into complacency by thinking that cooperation, especially between shifts, will thrive unless carefully nourished. The situation has to be watched constantly. Even when you get things going right you have to be ever careful to see that they are kept right. Adequate prices, good equipment, ample operating funds are all of no avail if handled by a non-cooperating organization.

The greatest factors in day and night cooperation are the attitude and real interest of the day and night superintendents. You cannot beat good example. If members of a construction organization see their superintendents working smoothly together, in a way that is mutually helpful, they are deprived of their first excuse. The men will realize that any non-cooperative spirit will be going against their own superintendent—their powder is wet right at the start if two bang-up superintendents are on the job. They won't get far with trivial complaints.

"Spending money for lighting is one sure way to save much more money in other directions."

I recall one crackerjack superintendent who, it seemed to me, spent the largest part of most every afternoon getting things lined up for the night men. He took a special pride in it. If, sometimes, there was a slip-up on the night shift, he would often assume the blame, saying he "fell down" in not having things ready for them. This man was soberly and deeply interested in the job and in his employer's welfare, not in just what his shift could do or in what personal glory he could direct towards himself. He was taken into his company as a partner long ago —such men do not remain the ranks.



Specific Aids to Night Work—I recall some of the things this superintendent used to do. If any water lines might require lengthening or changing during the night, he did it in the day time. If shooting was to be done, he had powder, wire and exploders where they could be got without delay. Necessary timber was placed near where it might be needed. A full supply of coal was at every machine. Shaky cars were removed from the trains and replaced by newly repaired ones. Track was placed in good condition. This "super" did everything he possibly could to make smooth sailing for the other shift. How smoothly *his* jobs sailed! The night men, in turn, did what they could to get him off to a good start in the morning. An ideal situation, you say. It is, but a common sense one and a necessary one, these close-priced days, if satisfactory results are to be obtained.

With right men in the right places most contract jobs can be managed this way. Construction work is a precise business, a business of detail, a business of cooperation and coordination. Too few construction men value highly enough the importance of detail. For instance, when the burners on those carbide lamps were plugged, the shovel runner told the others, "If I had one of the old lady's hair pins, boys, we'd be OK." The old lady's hair pin might have added from 60 to 75 cu.yd. to that night's output, at 42 cents a yard.

Importance of Detail—It is amazing how oblivious some construction men are to necessary, vital detail. By detail, I mean "little" things that have a "big" bearing. I have mentioned this before and will likely do so again. It is very important. The day superintendent making ready for the night superintendent, is detail. Being sure that lights are workable, is detail. Having cold shuts and bucket tooth pins ready for immediate use, is detail. Having generator brushes (they cost around 5 cents and are little larger than a pencil eraser) ready for instant use, is detail. But if they are not ready for instant use, your shovel may stand idle, in darkness, for several hours.

The list could be extended almost without end. A dragline operator was telling of a job he had just come from. He was complaining about the lack of extra parts for his machine. He mentioned that it was difficult to get the superintendent to keep extra lines on hand.

"We broke the dump line on the bucket one night," he said, "and when I looked in the usual place, under the machine, for another, it wasn't there. We monkeyed around a while and then decided to take a chance and cut 20 ft. from an extra hoist line that we 'happened to have.' Killed about an hour.

"The next morning I met the 'super' and he said, 'You raised the devil last night.'

"What do you mean?" I asked.

"You cut 20 ft. from that new hoist line. It was only long enough to give us about one turn around the drum. The line we were using broke first thing this morning. Now the machine is shut down while they splice in that 20 ft. you cut off last night."

Detail again, a pile of it, missing!

Costly Negligence—Lack of attention to detail, as it affects the efficiency of day and night shifts, each suffering from lack of aid from the other, the night shift almost always being the heavy loser, amounts to a great deal more than many construction men realize. And when the large cost of lack of day and night cooperation is superimposed upon the cost of lack of attention to important detail, the burden is too great for many jobs to bear and completion shows a loss—a loss that was not in the work at the start. Careless management put it there.

I could cite instances by the dozen in proof of this. What some of them amount to is nothing short of amazing. Cooperation and attention to detail between day and night shifts—between any shifts, any time—should be constantly and vigilantly watched. Not having one of the old lady's hair pins and lack of complete, wholehearted cooperation, have been the cause of as much lost money on contract work as low bid prices. This may seem to some an overstressed and glaring statement, but I make it deliberately. Look back at some of your disappointing jobs, and be honest. And look forward and apply what you can see in the mirror of the past. Again, I cannot resist repeating what one of America's great contractors always asked, always wanted to know, before a job was undertaken: "Who is to attend to it?"

"Too few construction men value highly enough the importance of detail."

NEXT MONTH—The fourteenth article in the series on "Helps to Successful Contracting," by Mr. Locher will discuss "Bidding Methods."

FLEXIBLE MAT of concrete placed in bags, reinforced in two directions and anchored to piles in slope, protects river bank above low-water level.

Novel River Bank Protection

Saves Highway Bridge and Fill

A NOVEL FORM of bank protection and revetment, involving wood piles, a steel-sheet baffle wall and a flexible mat of reinforced concrete placed in bags, was devised and built by engineers of the Ohio State Department of Highways to prevent further erosion of the Scioto River at Portsmouth, Ohio. Here continuous scour at a bend of the stream threatened a long fill and a 1,500-ft. through-truss bridge carrying U. S. route 52 into the city. Immediately after completion of the work two floods subjected the bank protection to a severe test and undermined a section of the concrete mat where submerged logs made it impossible to drive all plates of the baffle wall to grade. In repairing this damage an unusual method of dry cement grouting was adopted to solidify the underlying soil and the new fill placed behind the baffle wall. The stabilized revetment now appears to insure protection for many years to come.

Conditions at Site—In the vicinity of Portsmouth the Scioto River traverses low bottom lands with meandering course until it empties into the Ohio River. The meandering path followed by the river subjects its banks to great erosion in times of excessive rainfall and subsequent runouts. This erosion had been very rapid during the years 1923 to 1928 in the portion of the stream immediately above the highway fill and bridge. The loss of banks was greater each year, as the bend in the river became more pronounced, until the danger of losing the highway and the bridge as the result of the natural cutting through of the river became so acute that the highway department felt it necessary to install a system of steel jetties, or baffle plates, for a distance of about 3,500 ft. along the river bank to stop the erosive action of the river.

U. S. route 52, known as the Atlantic and Pacific Highway, is the only entrance to Portsmouth from the west. About 1½ mi. west of the city, the highway leaves the high ground and crosses the low bottom lands of the Scioto on a high fill, until it reaches the modern and expensive steel bridge, 1,500 ft. long and 24 ft. wide.

In the fall of 1931, the jetties began to go out rapidly. Within the course of a few months the jetties were in the middle of the river, and the bank had gone back more than 100 ft. in successive runouts. Something had to be done quickly to save the road and the bridge.

FLOATING DERRICK carrying swinging leads drives wood piles 25 to 35 ft. long in parallel rows along bank of river.

A careful study of soil conditions and of river action made by engineers of the highway department revealed the following facts:

1. U. S. Government dam No. 31, located in the Ohio river about 3 mi. west of Portsmouth, maintains a pool stage which gives a uniform depth of 12 ft. in the Scioto River.

2. The bank of the Scioto consists for a depth of 10 to 15 ft. at the top of fine silt deposited by the stream from year to year during periods of high water.

3. Underneath this layer of silt is a stratum of fine sand and gravel averaging 40 ft. in depth on top of rock or hardpan. The top of this sand stratum is 8 or 10 ft. above the average low water or pool stage of the river. Any current in the stream washes away sand until the overhanging bank falls into the river and is carried away, the rapidity of this process varying with the swiftness of the current. The erosion becomes very rapid when the Scioto reaches flood proportions with swift current before the Ohio has had time to rise to flood stage, killing the current and allowing silt to be deposited on the banks. The real damage is done by floods which are local to the Scioto.

Plan of Bank Protection—After consultation with engineers experienced in this type of work and with local residents familiar with the history of the river, and after taking into account the previous experience with the jetty installation, the highway department engineers decided to shape the bank to a 1 on 2 slope, place a steel-sheet baffle wall supported by piling at the toe of the slope (with the top of the wall at or near pool stage, or average low water, of the river), lay a concrete bag flexible pavement up the slope to a point above the top of the sand strata (the bags to be tied together with horizontal and vertical steel reinforcing), and pin the whole slope protection to the bank with wood piling driven to a depth of 30 ft. This type of protection confines the sand and guards it from scour down as far as the bed of the river. The flexible pavement follows any settlement of the bank, retarding scour in its descent, and immediately reveals any underwashing of the baffle wall, permitting the failure to be corrected before the next runout of the river. Protection above the sand stratum is unnecessary because by the time the river reaches this stage, backwater from the Ohio kills the current and prevents further erosive action.

After deciding on the method of protection, the highway department ordered 70,000 ft. of oak piling in lengths from 25 to 35 ft.; and contracted with the Portsmouth Sand & Gravel Co. to drive the piles with a floating derrick. The contractor drove an average of more than 1,100 ft. per day, on many days installing 55 30-ft. piles in 10 hours.

As soon as piledriving had progressed sufficiently, the state maintenance forces began driving the steel sheets for the baffle walls along the pil-

BAR REINFORCEMENT parallel with river bank is forced into freshly placed concrete bags behind row of piles.

SPECIAL ATTACHMENT *(left)* on steam hammer serves as guide in driving steel sheets of baffle wall at toe of slope. **GUIDE FOR STEEL SHEETS** *(right)* and special driving head are used in constructing steel-plate baffle wall.

TRACTOR-POWERED CRANE on barge handles and drives sheets of baffle wall.

ing at the toe of the slope. The sheets, furnished by the American Rolling Mill Co., of Middletown, Ohio, were 3/16 in. thick, 10 ft. long and 4½ ft. wide. They were driven on 4 ft. centers, with a lap of 6 in., the tops being kept about 1 ft. above pool stage of the river. The depth of 10 ft. placed the bottom of the baffle wall near the elevation of the normal bed of the river.

To drive the steel sheets, a barge was rented and a small ¼-yd. tractor-powered shovel, equipped with a boom, was placed on the barge to handle the sheets and driving hammer. The shovel remained stationary at all times, the barge being moved when necessary. The highway department force rented a No. 7 Union sheet-pile hammer and equipped it with a special attachment, illustrated by the accompanying photographs, to serve as a guide for the sheets and the hammer.

Driving progressed, as expected, at the rate of 150 lin.ft. of wall per day.

Large submerged logs extending back into the bank below water prevented some of the sheets from being driven to the full depth. These sheets were driven down to the logs, and the tops then were burned off. The short sheets caused trouble when the protection stood its first test. A torch was used to burn holes in the sheets through the lap, and the sheets then were nailed to the piling with railroad spikes.

Slope Paving—After cutting the bank to a 2 to 1 slope, with the steel-sheet baffle wall forming the toe, a force of four paving crews began the construction of the flexible bag-concrete mat. A battery of five Jaeger and Rex concrete mixers was placed on the river bank with the units about 25 ft. apart. The extra mixer was employed to eliminate delay in moving equipment. Four mixers were in operation at all times, and the fifth machine was moved to the head of the line as the slope paving at the rear was finished. The paving crews simply moved ahead one mixer.

BATTERY OF FIVE MIXERS (four of which can be seen) keep four mixing and paving crews operating without interruption.

Calcium chloride bags of 100-lb. capacity were used in the construction of the flexible mat. These bags, which have no salvage value for any other purpose, are made of burlap with paper lining cemented to the fabric. About 80,000 bags were utilized to pave the slope.

River run sand and gravel containing about 50 per cent sand was employed in mixing the concrete. The proportions were one part cement to eight parts of mixed aggregate, requiring about 3.6 bags of cement per cubic yard of mixed concrete. A rather wet mix was used. After the bags had been filled and tied with stove pipe wire, they were placed in chutes laid on the slope to carry the bags down to the pavers. At the bottom of the chutes, the pavers picked up the bags and laid them in place on the slope, with each bag lapping its neighbors horizontally and vertically. When in place, the bags were punctured with steel bars to allow the confined air to escape. This puncturing permitted the bags to lie flat and caused the wet concrete to run out and bond the lapped portions.

WIRE TIES *(right)* in shape of croquet wickets are pushed into freshly placed concrete bags to join each bag to its neighbors.

BAGS FILLED WITH CONCRETE by mixing crews at top of bank slide down chutes to pavers who place them on slope with each bag lapping its neighbors horizontally and vertically.

At the toe of the slope, parallel with the baffle wall, the pavers pushed ½-in. steel rods 20 ft. long through the bags of the lower row while the concrete was green. About every 10 ft. up the slope, especially on the upper side of parallel rows of piles, similar lines of reinforcing were pushed into the bags. In similar fashion, ½-in. steel rods in transverse direction were installed about 6 ft. apart. Reinforcing thus was provided in rectangles about 6x10 ft., with the transverse rods perpendicular to the shore line serving to hang the bags on the upper rows of piling. Further to tie the individual bags of the mat into a flexible unit, the pavers installed No. 4 gage galvanized wire ties shaped in the form of croquet wickets between each bag and its neighbors. The wickets were pushed into the concrete as soon as the bags were laid.

An average of 3,500 bags was laid per day, and 3,400 ft. of slope was completed in 18 days with the four crews. The schedule of operations worked out perfectly, as the last bag was laid 1 day after the piledriving crew had finished. About 65 days had been required to complete the piledriving.

Flood Damage—On the following day, it began to rain locally on the Scioto River watershed, and in 2 days the river was a raging torrent, with the Ohio practically stationary. The river rose to about 18-ft. stage, with the current unusually swift at the location of the protection.

When the flood subsided, some damage was noted at the location of the short sheets where submerged logs had been encountered. Before an intelligent survey of the damage could be made, a general rain occurred over the Scioto and Ohio valleys. The river

completely flooded the entire protection work and the bottom lands, finally reaching about the 40-ft. stage. A particularly swift current occurred at about the 24-ft. stage, near the top of the pavement, during this rise of the Scioto. A survey of the damage after the waters had subsided showed that the damage caused by the second run-out was greater and, again, that it was due to underwashing of the toe at the location of the submerged logs.

A section of the protected bank inside the steel baffle wall, about 400 ft. long and 8 to 10 ft. wide, had been washed out clear to the bottom of the river bed, 10 to 12 ft. in depth. The concrete bag carpet had followed the contour of the bank and hung like a curtain from the piling, intact in many places. Where the paving had broken, the bags had dropped to the bottom the hole, although still held together by the reinforcing.

A plan was adopted to place more permanent protection at the damaged section. Concrete bags were laid along the baffle wall, one on another, and were reinforced vertically to keep the bags from sliding out into the river under the sheets, which were undermined in some places. This construction virtually formed a flexible concrete wall next to the baffle wall, permitting settlement as the sand underwashed. Bulkhead walls of concrete bags reinforced vertically were built from the front wall back to the bank, dividing the undermined space into 50-ft. sections.

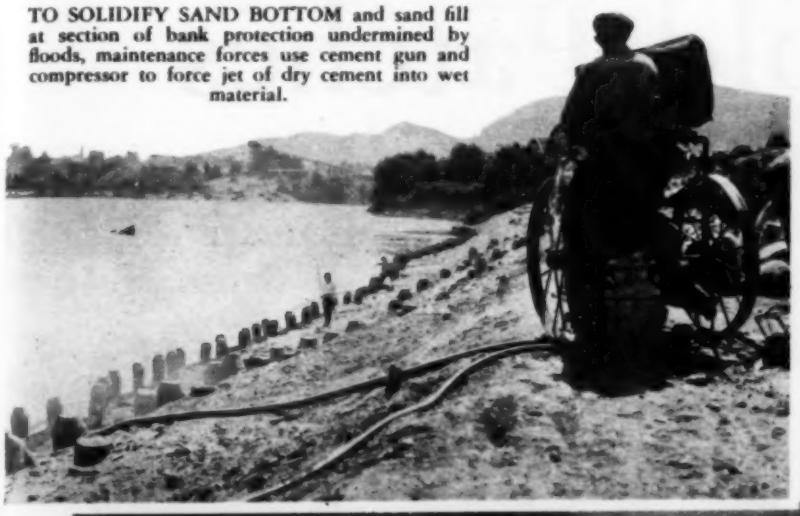
Solidifying Fill—It was decided that some means had to be found to solidify the underlying sand bottom and the fill placed in the holes. The method adopted consisted essentially of blowing dry cement into the wet sand by means of a jet pipe, thus transforming the wet sand into concrete. To carry out this plan, the highway department forces made use of a 15-ft. length of 1-in. pipe, with handles and control valves at the top, and a cement gun supplied with air by 120-cu.ft. compressor. Before placing any fill in the holes which had been washed out behind the baffle wall, the jet pipe was inserted through the bag pavement which lay at the bottom of the holes, with the end of the pipe about 5 ft. below river bottom. Pure dry cement was blown into the pipe under pressure, the pipe being raised gradually as the jetting progressed. The jet distributed cement over a radius of about 8 ft. After setting, the cement produced a fairly dense concrete. It is estimated that about 3 bags of cement per cubic yard of material were distributed into the sand at each insertion. When one area was finished, the jet was moved ahead 5 or 6 ft. and the operation was repeated.

After the portion of the river bed below the dropped pavement had been completed, a derrick boat clammed sand from the river over the baffle wall and into the holes until the holes had been filled up to the surface of the water. This sand filling then was thoroughly solidified in the same manner with the jet pipe, virtually forming a concrete wall 8 to 10 ft. wide and 10 to 12 ft. deep, divided into 50-ft. sections by the bulkhead walls, with the concrete bag wall on the river side. The entire structure is capable of settlement behind the baffle wall. Owing to the cheapness of the sand and gravel filling, and to the low cost of the jetting operation, which required the services of only three men, the engineers found this method to be a cheap and quick way of producing a non-erosive filling.

After the jetting operations had been completed, the slope was reshaped with sand and gravel clammed from the river, the concrete bag pavement relaid, and the slight settlements corrected until the whole protection had been restored to its original condition.

Direction—Under O. W. Merrell, director of highways, and G. M. Anderson, division deputy director, the bank protection work was carried out by Thomas E. Morgan, assistant division engineer of maintenance, who cooperated in the design of all ideas and methods used on the project. A. E. Dillon, division superintendent, was in charge of all labor operations, and Hugh Schwart, division equipment superintendent, was responsible for furnishing and adapting equipment for the various operations. Joseph B. Belcher, Scioto County highway superintendent, supervised employment and delivery of materials, and Joseph N. Doyle, resident engineer, Scioto county, furnished necessary engineering services. John Doll was in charge of slope and paving operations for the state highway department, and Merritt C. Rolfe supervised piledriving operations. For the Portsmouth Sand & Gravel Co., Galley Peters was foreman of the piledriving crew on the bank revetment work.

TO SOLIDIFY SAND BOTTOM and sand fill at section of bank protection undermined by floods, maintenance forces use cement gun and compressor to force jet of dry cement into wet material.

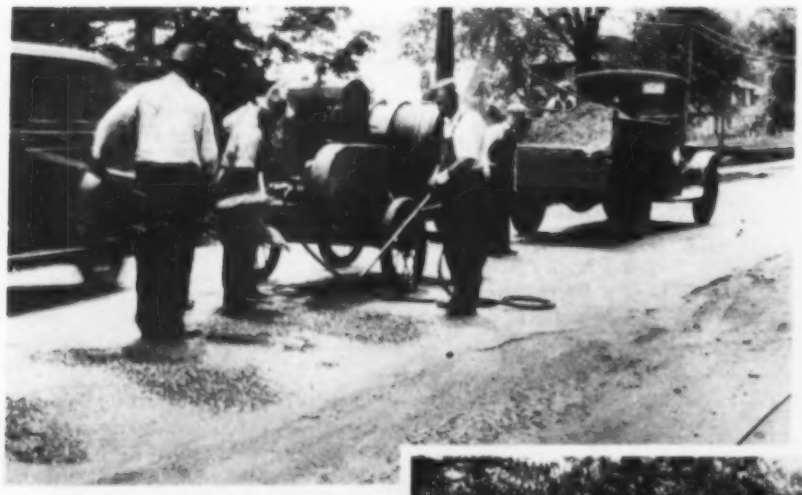


BANK PROTECTION consisting of wood piles, steel-plate baffle wall, and reinforced bag-concrete mat checks erosion and saves highway bridge and fill in background.

JETTING SAND FILL behind baffle wall with dry cement forced through 1-in. jet pipe produces non-erosive concrete backing for undermined section.

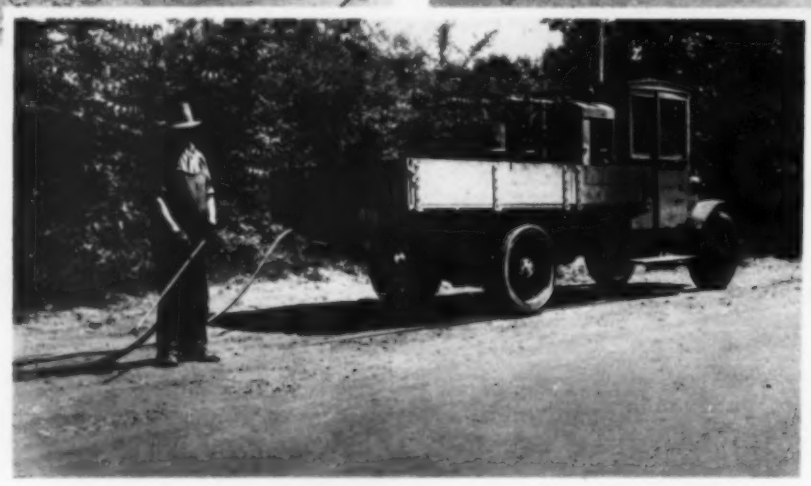
Portable Repair Units Cut Costs of

Asphalt Cold Patches



FIRST PORTABLE OUTFIT, built in 1931, applies pressure spray to patches.

1931 MODEL consists of pump and tank mounted on old mixer chassis.



SECOND UNIT, assembled in 1932, is mounted on salvaged truck.

TO OBTAIN greater economy and flexibility in maintaining bituminous pavements, Willard S. Conlon, city engineer of Stamford, Conn., has experimented during the last three years in building portable road repair units for making cold patches. Each year he has assembled a patching outfit from parts of discarded equipment in the city's yard. Continued improvement in these units has lowered the cost of cold patches in 1932 from $1.50 per square yard by the old pouring-pot method to 59c. per square yard, using two portable outfits. A better patch was obtained at the lower cost, as this price included rolling, which was omitted from the former figure. All patches are made with trap rock and emulsified asphalt.

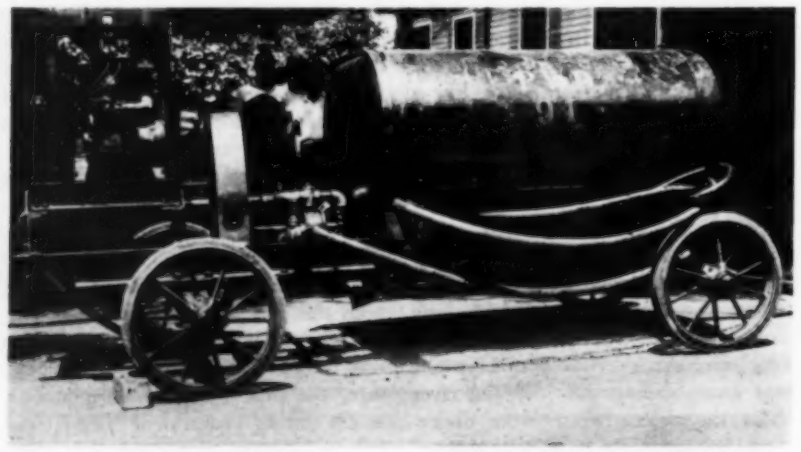
In 1931, the city's public works department built its first portable cold-patch outfit, utilizing the chassis of an abandoned concrete mixer as the base for a pump and asphalt tank. On the chassis, which had solid rubber tires on its steel wheels, the department's mechanics laid a soft pine deck to carry a 110-gal. storage tank and a Goulds rotary pump operated by chain drive from a LeRoi two-cylinder gasoline engine. The pump was recovered from an obsolete, horse-drawn bituminous spreader, and the motor, with attached clutch, from a discarded concrete mixer. A guard was placed over the chain drive and sprocket wheels to protect the operator. The cost of the outfit was $50.

A year later, the city built its second patching outfit, a self-propelled unit mounted on a salvaged truck. A pump and motor similar to those employed in the first outfit were retrieved from abandoned equipment and applied to this unit. Total cost of constructing the outfit, which required making a new truck body, amounted to $110. This unit is most efficient in making patches scattered over a wide area.

Larger asphalt capacity is provided by the third and last unit, of the trailer type, constructed in May, 1933. The department purchased a 250-gal. welded steel tank and a Goulds 1¼-in. rotary pump and mounted them on the chassis of an old Wonder concrete mixer with 96-in. wheelbase, utilizing the mixer's two-cylinder LeRoi motor as the power unit. This outfit cost only $75 to build, including the purchase of the tank and pump.

Design and operation of the patching outfits are illustrated by the accompanying photographs. To assist in relieving unemployment, all workmen with the exception of the oil ejector operator, are rotated each week.

SPRAYING LIQUID ASPHALT pumped from tank on latest unit.



1933 OUTFIT, of trailer type, has 250-gal. tank on mixer chassis.

JOB ODDITIES

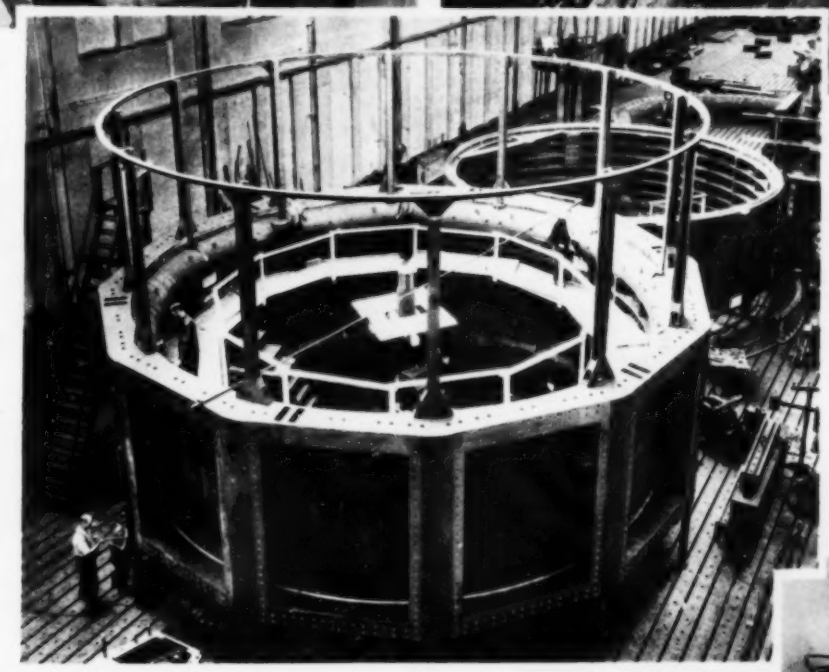
A Monthly Page of Unusual Features of Construction

CONSTRUCTION ARSENAL. Police headquarters at Boulder City, Nev., is completely equipped to handle any disturbance that may arise among workers on the Boulder Dam. In addition to keeping order in the construction city, the police squad maintains a station on the main highway entering the Government reservation, where suspicious characters are held up and interrogated.

Wide World Photo

CHISELING on a grand scale, but not in violation of the NRA regulations. Workmen, under direction of Gutzon Borglum, carve head of George Washington on side of Mt. Rushmore as part of gigantic sculptured memorial.

Keystone Photo

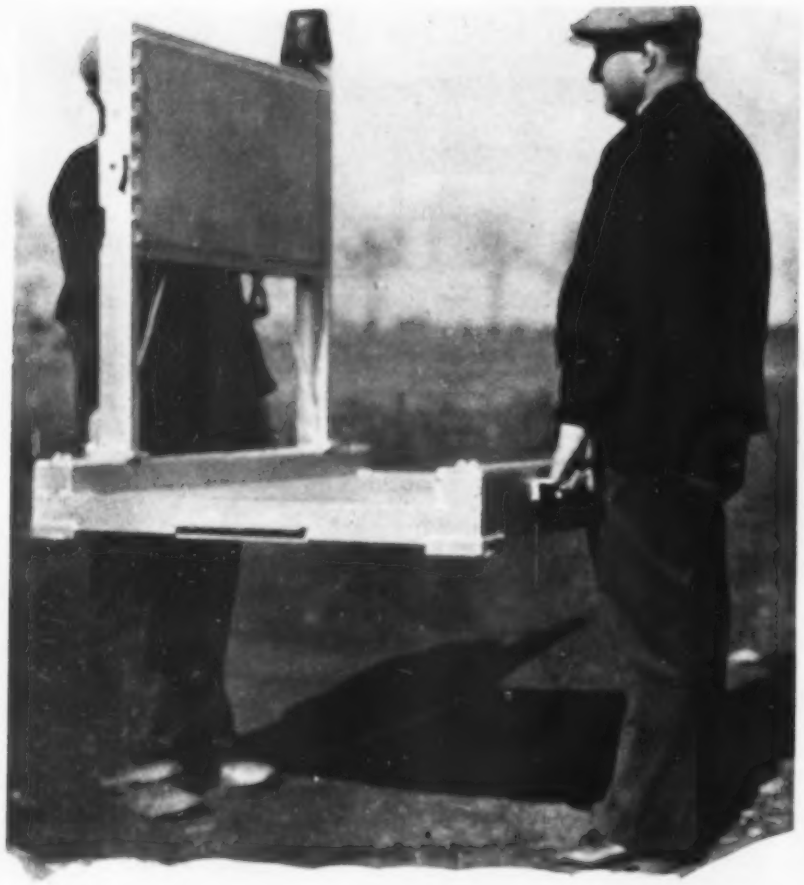


WORLD'S LARGEST VALVE. One of eight arc-welded intake tower gates, 37 ft. in diameter, and 25 ft. high, being fabricated at Westinghouse shops in Pittsburgh, for shipment to Boulder dam to control flow of water to power plant. Each gate assembly weighs 523,858 lb. and consists of a throat liner, a cylindrical valve, a nose liner and valve guides and minor fittings. Dismantled for shipment each gate will require eleven railway cars.

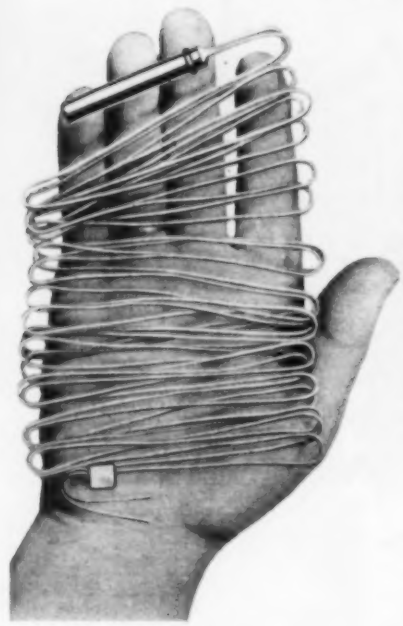
TINY WELDER AND CUTTER. At its exhibit at the Century of Progress Exposition, Chicago, Union Carbide & Carbon Corp. displays miniature oxy-acetylene units complete in all details.

HOUSE WRECKING BY MACHINE *(left)*. On a highway contract in Greene County, N. Y., Owen P. Williams, contractor, of Oneonta, used his Koehring power shovel to lift, drop and break up a frame structure on the right-of-way.

NEW EQUIPMENT *on the Job*



LIGHT, EASILY HANDLED BY TWO MEN is folding platform scale for small concrete jobs where weight proportioning of sand, gravel or stone is specified. Platform is 30 in. wide, 42 in. long and 3¼ in. high. Weigh beam is graduated to 500 lb. in 2-lb. divisions. Separate tare beam and sliding weight is provided for balancing empty wheelbarrows. Beam lifter for each weigh beam operated from outside weatherproof beam box. Other features: Extra large hardened steel knife edges and shackles; brass weigh beams and poise weights with rustproof graduations; scale levers of all-steel construction, and springless balance indicator for accurate and rapid weighing. — The C. S. Johnson Co., Champaign, Ill.



FOR SAFETY AND CONVENIENCE of users of Atlas insulated, match-head electric blasting caps, this accordion fold tube package has been designed. In it wires are folded accordion-wise *(left)* and folds are laid around blasting cap to protect and cushion it on all sides, thus providing adequate resistance to external shock. Assembly placed in round paper tube *(below)* which, when broken, allows wires to be pulled out instantly without danger of kink or snarl.—Atlas Powder Co., Wilmington, Del.

CHINESE SPIRAL SCARIFIER for reconditioning oiled earth, cinder and gravel surfaces. Spiral has auger-like action so that when in rotating contact with ground surface it digs in, cuts off, chews up, turns over and mixes. Depth of cut regulated by mechanical controls. Rebuilds top 2 or 3 in. without disturbing base, giving surface free from ruts, chuck holes and corrugations. Length (excluding tractor hitch) 12 ft.; diameter of spiral, 18 in.; extreme width, 7 ft.; approximate shipping weight, 4,800 lb. Track-type tractor recommended for power.—Moritz-Bennett Corp., Effingham, Ill.

EMERGENCY LIGHTING OF TRUCKS provided by carbide gas lantern *(right)* with front lens for illumination of standing machine as safety measure and for repairs and with red rear light which affords warning to oncoming traffic. Constructed with handle and bail for carrying. Easily charged with carbide and water; also easily emptied. Lens of heat-resisting glass. Lantern withstands all sorts of weather conditions and penetrates fog. Will burn 8 hr. on 8-oz. charge of carbide and on one filling of water chamber. Detachable spring bracket supplied for attachment to truck.— National Carbide Sales Corp., Lincoln Bldg., New York City.

WIDER ANGLE OF VISION and greater protection against light and sparks are provided by these new type welding spectacles with canvas-bakelite frame and 50-mm. lenses. Temples (bows) covered with insulating material. Frame, which is non-flammable and does not conduct heat, may be spread by means of a snap device, and lenses changed in few seconds. Lens, flat-ground and polished, made in light, medium and dark green shades.—Linde Air Products Co., 205 East 42nd St., New York City.

ROBOT LOADER, a self-propelled mechanical shovel for handling ore and muck in limited confines, both above and below ground. Will operate in space 4 ft. wide and 6½ ft. high and load 16-cu.ft. mine car in from 30 to 45 sec., giving it a capacity ranging from 40 to 60 tons per hour. In addition to loading, Eimco-Finlay loader will tram and switch loads within range of its air hose connections. Power for propelling, crowding and loading furnished by two Ingersoll-Rand motors operated by central control through a quick-acting throttle for operator's use. Air consumption varies from 30 to 70 cu. ft. per minute at pressures ranging from 60 to 90 lb.—Eastern Iron & Metal Co., 634-666 S. Fourth West St., Salt Lake City, Utah.

If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

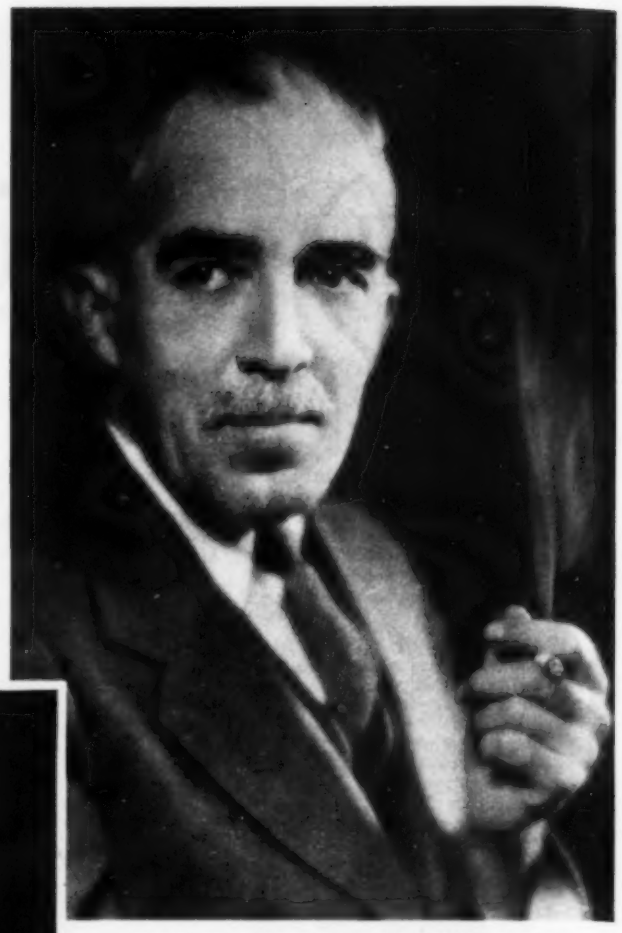
The manufacturers, however, will be glad to supply further details if you will write to them.

DETECTING HIGH OR LOW SPOTS in pavements is purpose of this Austin surface inspector which communicates its findings to the operator by sounding an electric buzzer. Extent of irregularity can be determined accurately as buzzer continues to sound until high or low area is passed by center wheel. Concrete can be checked as soon as free water has escaped, without marring or disturbing the surface. In similar way, asphalt may be checked before it becomes unyielding or hard. By using two detachable guide clamps, device is converted into an efficient concrete form checker. Surface inspector weighs 12½ lb. and may be folded up and transported by hand. — The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill.

ELECTRIC HAND-BELT 3-IN. SANDER *(left)* for surfacing almost any material (with correct abrasive belt) either flat or curved. Balance of machine not only from right to left but from front to rear is responsible for these advantages: Ease of operation; smooth, flat finish on materials; faster sanding, and low operating cost. Weight, 15 lb. Powered by ½-hp. motor operating from light socket, a.c. or d.c. Furnished with bench stand, if desired. Uses standard 3x24-in. belt.—Porter-Cable Machine Co., Syracuse, N. Y.

Present and Accounted For—

A Page of Engineering Personalities in the Service of The Federal Emergency Public Works Administration at Washington, D. C., Under Col. Henry M. Waite, Deputy Administrator



EXECUTIVE OFFICER. Major Philip B. Fleming, Corps of Engineers, U.S. Army, has served at a number of army posts and district engineer offices. His recent assignments have included duty in the U.S. District Engineer Office at New York City, as chief of the finance division, office of the Chief of Engineers, member of War Department Board on Contracts and Adjustments and senior instructor in military engineering, U.S. Military Academy.
Underwood & Underwood Photos

EXECUTIVE ASSISTANT. Major Robert W. Crawford, after service in France during the World War, became district engineer for the Engineer Department of the Army at New York, Duluth and Honolulu. Later, detailed to the office of the Chief of Engineers at Washington, Major Crawford became chief of the construction and the railway sections, military division.

EXECUTIVE ASSISTANT. Col. E. W. Clark has been closely associated with Deputy Administrator Waite, having served with him on the Cincinnati Union Terminal and in the Transportation Corps in France during the War. Previously he had been connected with the Pennsylvania and Monongahela railroads and had wide experience in the contracting business.

DIRECTOR OF ENGINEERING. Clarence McDonough has had a broad experience in the contruction of bridges power plants, reclamation and irrigation projects and river and harbor work in the United States, Canada, South America and European countries. He is a graduate of Massachusetts Institute of Technology.
Harris-Ewing Photo

DIRECTOR OF FEDERAL PROJECTS. Fred E. Schnepfe, until joining the staff of the Public Works Administration, had been chief engineer for the Federal Employment Stabilization Board. Formerly he was assistant engineer with the Maryland State Roads Commission, county engineer of Queen Anne County, Md., and district engineer for the North Carolina State Highway Commission. During the War he served with the Construction Division of the Quartermaster Corps.

Showing portion of U. S. Navy Yard, Brooklyn, N Y

6 U. S. NAVY YARDS USE SINCLAIR OILS

How well Sinclair refineries are equipped to supply a complete line of lubricants is illustrated by the fact that U. S. Navy Yards at Boston, Brooklyn, Philadelphia, Norfolk, Va., Portsmouth, N. H., and Charleston, S. C. use Sinclair lubricants.

In these famous yards, Sinclair oils are put to wide use in lubricating power-generating machinery, reciprocating engines, steam turbines, in the forge shop and in lubricating machine shop equipment of the heaviest duty.

From the same Sinclair refineries that supply these U. S. Navy Yards come 200 finished lubricants, each designed to meet a specific lubricating problem in industry and transportation. Not only the U. S. Navy but fifty-two leading American Railway systems, scores of shipping firms and countless industrial plants use Sinclair oils and greases and secure dependable lubrication.

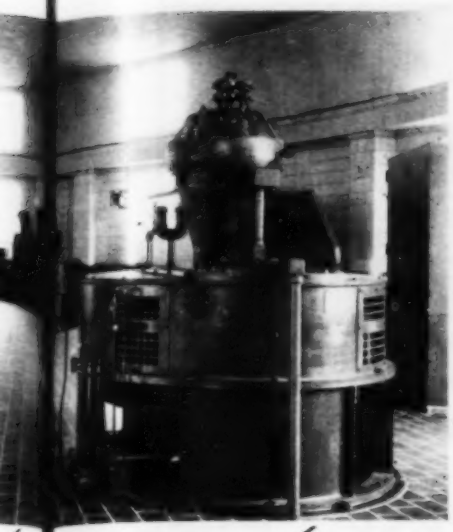
Sinclair Engineering service is at your command. Call or write our nearest branch office or any local Sinclair Agency. Sinclair Refining Company (Inc.), New York, Atlanta, Chicago, Houston, Fort Worth, Kansas City. Sinclair Refining Company of California, Los Angeles.

Tune in Monday evenings 40 NBC Stations — SINCLAIR MINSTRELS

SINCLAIR

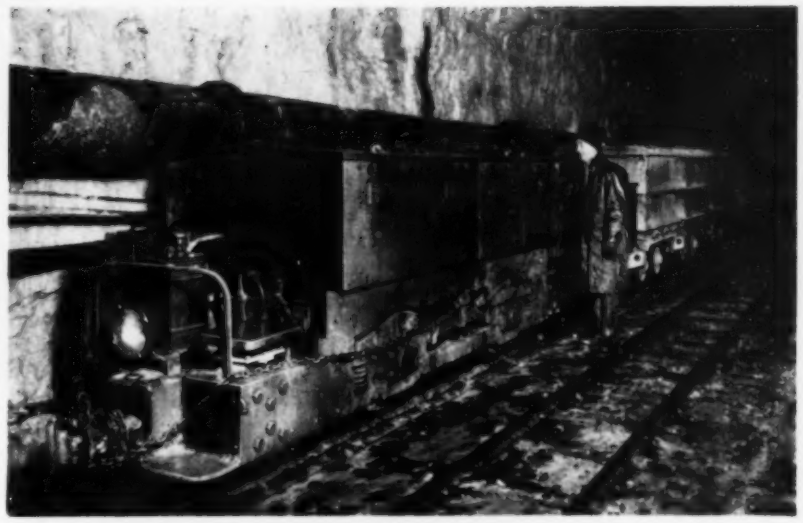
NRA MEMBER U.S. WE DO OUR PART

INDUSTRIAL OILS FUEL OILS GREASES



IN CHICAGO'S NEW WATER TUNNEL

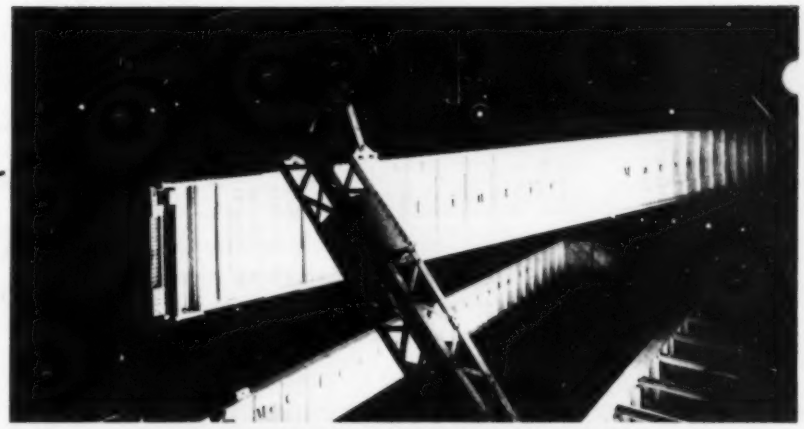
Operating on tracks often deep in mud and water, eleven G-E storage battery locomotives pull heavy loads of rock, remove refuse, and supply construction materials. On the job for over two years, they have never failed to provide economical, trouble-free transportation



LET US HELP YOU USE ELECTRICITY TO YOUR GREATEST ADVANTAGE

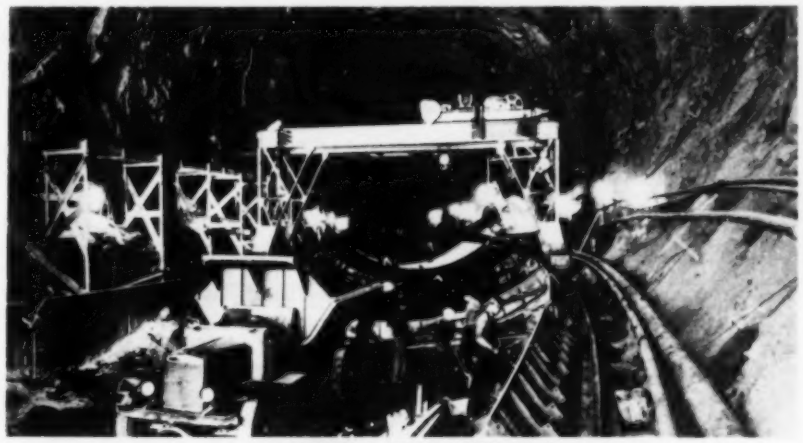
IN the construction and operation of every type of public works, General Electric equipment serves with a dependability that talks the contractor's language. For here is equipment that stays on the job days, nights, and Sundays, asking little for upkeep, getting the most out of the construction equipment, safeguarding men and machinery.

The high standing of G-E equipment among civil engineers and contractors rests upon many factors other than the quality of the equipment itself—engineering help when it is needed; prompt manufacturing and shipping cooperation when time is precious; immediate stock shipments from conveniently located warehouses when standard supplies are desired quickly; a nation-wide chain of service shops; highly trained specialists with whom to deal in every transaction—all to help you keep the job moving profitably. General Electric Company, Schenectady, N. Y.



133-TON GIRDER FOR N. Y. POST OFFICE ADDITION

When this huge girder — believed to be the heaviest ever used for a building — was hoisted into place at the New York City Post Office Addition, G-E motors did the lifting, while G-E Thrustor-operated brakes provided protection to both job and workmen



CONCRETING AT HOOVER DAM

Lining the diversion tunnels at the rate of 2300 cubic yards of concrete a day, for weeks at a time, was accomplished economically with the help of this G-E equipped gantry crane—one of the first to operate successfully on a curved temporary track

200-742

E L E C T R I C

Once Upon a Time

Adam fell an easy victim to Eve's Sales Talk. The product, however, was badly misrepresented and proved to be an Abysmal Disappointment. Thus Sales Resistance was born, baffling Selling Forces even unto this day, augmented as they are by the Learned Men of all the Arts and Sciences (including Advertising). The Buying Public has the Grain of Salt habit, but not even half a grain of NaCl need be taken with the following statements about Carnegie Steel Sheet Piling.

We've been selling piling since February 21, 1906. Our sections cover a range of weights and sizes that experience has shown are suitable for your needs. Since 1906 we've sold hundreds of thousands of tons of piling and have had a hand in the engineering details involved in its use. We'll be happy to share with you the knowledge we have gained. Very likely your problem fits in with one or a dozen we've already helped solve.

We've been told our piling hand book is mighty fine and helpful. If you haven't a copy, send for one. Although this advertisement begins with "Once Upon a Time," our desire to work with you is no Fairy Tale.

CARNEGIE STEEL COMPANY

Subsidiary of United States Steel Corporation

PITTSBURGH, PA.

232

not all Crawler tractors are CLETRACS

. . those are which set performance records

IN continuous day-after-day performance, on the road-building project shown below, Cletrac 80's delivered material at both ends of a 4000-foot haul at the rate of a cubic yard a minute—over a 25% maximum grade. This dynamic achievement—setting a new record in efficient tractor operation—is typical of Cletrac performance. Such results are entirely due to advanced features of design and construction exclusive to Cletracs. We invite you to check them and buy on comparison. It will mean money in your pocket. We make crawler tractors exclusively—Model 80 the world's most powerful automotive unit, and models with horsepower rating 55-35-25-20.

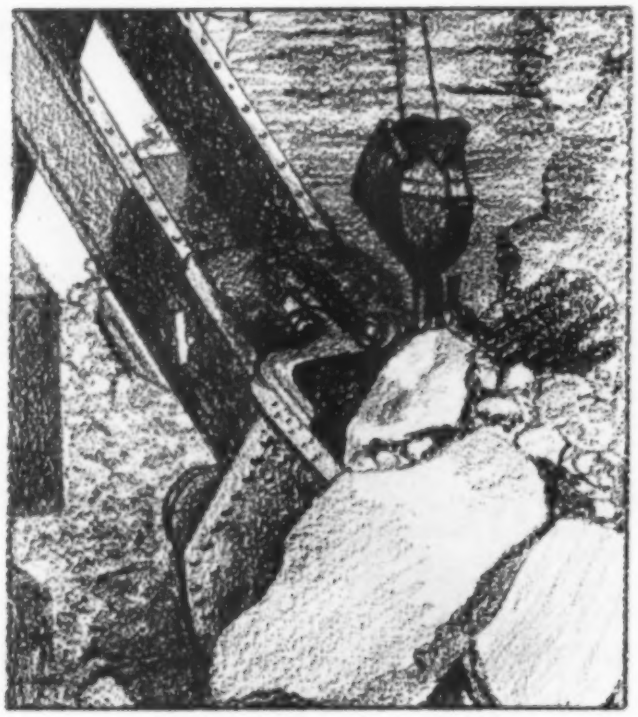
THE CLEVELAND TRACTOR COMPANY, CLEVELAND, OHIO, U. S. A.

Industrial Cletracs

Model 80, $4650.00 Model 55, $3600.00
Model 35, $2475.00 Model 25, $1850.00

Prices F. O. B. factory include electric starting equipment.

Cletrac
REG. U.S. PAT. OFF.
Crawler Tractors
Built To Endure



Juggling or DIGGING?

Juggling the big boys is spectacular . . . requires a skillful operator . . . is tough on the shovel . . . tough on you. Digging the little fellows is easier, quicker, more profitable.

Therefore it pays to plan your shots so as to get more little fellows—better fragmentation as well as displacement. And one of the secrets of better fragmentation is in the priming and hook-up—with Cordeau-Bickford Detonating Fuse.

Write for the Cordeau Book.

CB-23

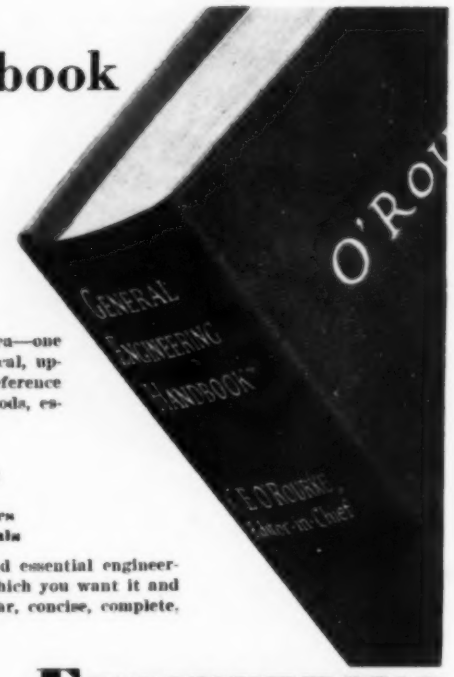
THE ENSIGN-BICKFORD COMPANY

Simsbury, Conn.

CORDEAU BICKFORD

CORDEAU DETONATING FUSE BICKFORD

The ideal book *for the construction engineer*



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POINTS OF SUPERIORITY

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A single construction feature may be the determining factor in the choice of a motor grader, when the other machines considered are without that advantage. In the versatile Austin Model 77 there are ten distinctive features, any one of which is a reason for your preference. Taken together they offer a very definite value in improved performance.

The design of the entire machine is directed toward firm blade action. Read the ten points listed here and realize how inevitably they must produce the one desirable result to the contractor and engineer—*maximum effective application of power —under easy control—at low cost.*

Not the power alone but its application increases the scope of the machine beyond the usual range of a motor grader. For example, by means of the wide front axle and leaning wheels, light ditching jobs are made entirely practical. A score of other special uses can be described.

Now is an excellent time to post yourself on the savings made possible by this machine on your work. Write us for complete details on these Ten Superiorities.

The Austin-Western Road Machinery Co., Home Office: 400 N. Michigan Avenue, Chicago, Ill. Branches in principal cities.

1 WIDE FRONT AXLE WITH LEANING WHEELS equalizes load—no side draft.

2 POWERFUL SIX CYLINDER MOTOR—optional Diesel motor.

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6 CHATTER PROOF LOCK—rigid bracing holds blade in a 4½ ton vise.

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8 SIXTY INCH DIAMETER CIRCLE with blade arms and braces welded into single unit for rugged blade support and positive action.

9 BALL AND SOCKET JOINTS throughout for easy prevention of lost motion.

10 GRADE-OMETER in the cab indicates angle of the blade regardless of the machine's position.

85 YEARS OF LEADERSHIP IN ROAD MACHINERY

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ROAD ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS, SWEEPERS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS, MOTOR GRADERS, DRAGS, SHOVELS, DISTRIBUTORS, WAGONS, SNOW PLOWS.

The Austin-Western Road Machinery Co.
400 N. Michigan Ave., A6, Chicago, Ill.
Send complete information about the Ten Points of Superiority of the Austin Model 77 Motor Grader.
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"FULL SPEED AHEAD, MR. JONES!"

"AYE-AYE! WITH THE REX '49ers

Any construction job moves faster with Rex Construction Equipment on the job—Why?

for water

Rex Speed Prime Pumps give the capacity of high speed centrifugals—maintain it by automatically cutting off recirculation—and handle air leaks in the line and solids and gravel in the water.

The Reasons—the Rex Recirculation Cut-off stops all recirculation of water once the prime is established and makes the Rex Speed Prime the outstanding contractors' pump . . . And the "Peeler"—the exciusive Rex feature—which is the one big reason why the Rex has the fastest priming time and the greatest air-handling capacity—*size* for *size* and *lift* for *lift*.

If you are interested in pumps for any dewatering, contracting, bridge, utility or industrial job, write for Catalog No. 240, "Rex Speed Prime Pumps."

1. Tilter 3½
2. Mixer 5-S
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9. Moto-Mixer 1 yd.
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21. Paver 27-E
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23. Pumpcrete Single
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25. Plaster and Mortar Mixer No. 11
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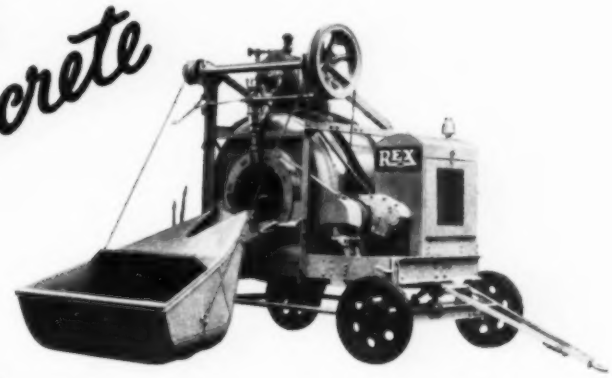
27. Speed Primer Pump 2"
28. Speed Primer Pump 2½"
29. Speed Primer Pump 3"
30. Speed Primer Pump 4"
31. Speed Primer Pump 6"
32. Diaphragm Pump 3" S
33. Diaphragm Pump 4" O
34. Diaphragm Pump 4" SC
35. Diaphragm Pump 4" DO
36. Diaphragm Pump 4" DC
37. Diaphragm Pump 4" F
38. Sludge Pump—Single
39. Sludge Pump—Double
40. Road Pump—80-gal.
41. Road Pump—125-gal.
42. Saw Rig No. 3
43. Saw Rig No. 5
44. Cold Patch Mixer
45. Contractors' Elevators
46. Bulk Cement Plants
47. Belt Conveyors
48. Belt Idlers
49. Central Mixing Plants

for concrete



Deliver your aggregates and cement to the skip or batching plant—Rex does the rest—mixes it in mixers of all standard capacities from the 3½-foot Tilter to the 84-S—mixes it fast and mixes it well . . . Delivers it as suits your needs—by Belt Conveyor, Moto-Mixers, or direct to the forms with the Rex Pumpcrete—write on the equipment that interests you.

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City..... State.....

Contractors: Before you buy—before you bid—investigate the Rex '49ers—the 49 complete machines built for the contractor by

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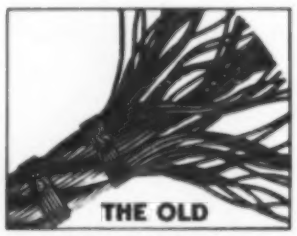
THE MOST COMPLETE LINE BUILT

We like 'em
"HARD BOILED"

. . . if they ask us to *prove* that TRU-LAY Preformed Wire Rope will save them money. We welcome such an inquiry from a man who knows what he wants . . . and wants to be shown. That's the way our best customers have been hatched, because shrewd and careful buyers are alive to possible savings in wire rope.

We expect you to be "hard-boiled" in the matter. Because we know if you convince yourself that TRU-LAY gives much better and longer service, we will add another customer to our long list of TRU-LAY users.



NON-PREFORMED

PREFORMED

"I-T" (internal tension) in wire rope is eliminated by preforming strands and wires to their exact helical shapes . . . so they lie in place *relaxed*. As a result, TRU-LAY Preformed Wire Rope gives much longer service and greater efficiency.

TRU-LAY combats fatigue, is easier and safer to handle, resists kinking and high-stranding. Each strand carries an equal load.

The sum of these and other advantages results in worth while wire rope savings.

Tell us your wire rope usage and service. Our experience over a long period of years, in hundreds of instances and applications will prove in good stead . . . to lower *your* wire rope costs, just as we have lowered wire rope costs for others.

Try TRU-LAY Preformed Wire Rope. An ounce of experience is worth a ton of advice.

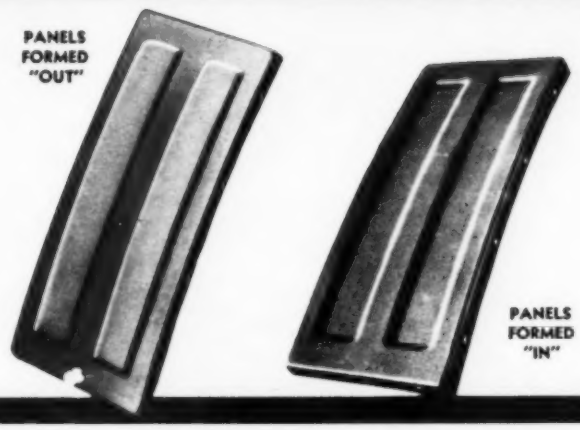
Address the AMERICAN CABLE COMPANY, *Inc.*
WILKES-BARRE, PENNSYLVANIA

An Associate Company of the American Chain Company, *Inc.*
District Offices: Atlanta, Chicago, Detroit, Denver, Houston, New York, Philadelphia, Pittsburgh, San Francisco

Underground Structures

Are Built Stronger, Safer, Easier and at Lower Cost with

TRUSCON STEEL LINER PLATES



This advanced method of underground construction is extensively used for tunnels, subways, caissons, shafts, sewers, etc. —speeding the erection, providing remarkable strength and permanent safety, and cutting costs of time, labor and materials. Expensive shoring is eliminated and excavation is minimized. No danger of cave-ins or lost headings. No need to worry about ground conditions. These powerful steel plates are accurately formed to required radius for easy assembly with bolts into enduring structures of any standard contour.

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MAIN OFFICE: YOUNGSTOWN, OHIO

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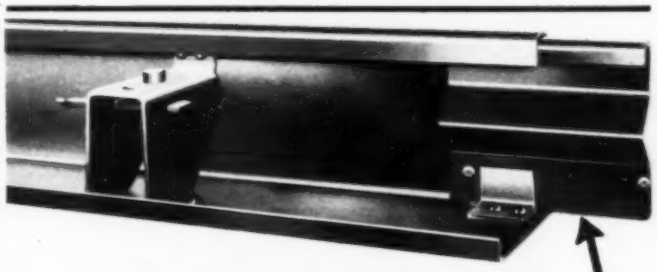
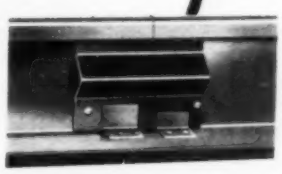
A REAL IMPROVEMENT in ROAD FORMS:



The Jaeger-Lakewood Improved Road Form:
It is much more rigid.
It is self aligning.
It is easier to lock.
It outlasts all others.

LOOK AT THIS JOINT!

Of ¼" high carbon steel, 2" longer than most joint plates, completely telescoped with top rail for rigid alignment. Angle extends 1½" for easy hammering, eliminates 90 per cent of plate "brooming" and breakage.



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GUINAND *and* GALLET TIMERS

-you CAN make a road without a STOP WATCH BUT you CAN'T make a full PROFIT without one.

JULES RACINE & CO.
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Please forward Timer Catalog CMB showing Timers for road work . . .

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Address _____ City _____

Standard for 40 Years

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"We are more and more impressed, with the reading of Mr. Locher's articles, with the valuable information contained in his discussion of the practical and business side of construction work."

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"I have always thought CONSTRUCTION METHODS the best construction magazine obtainable, and with the last two copies I find it "everything that can be desired."

Superindendent

"I am pleased to say I have been a subscriber to CONSTRUCTION METHODS since it started. It has changed wonderfully for the better with the passing of the years, and you are making it more interesting now than ever before."

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"This cancellation was sent to you on receipt of your bill in line with general policy of cutting down surplus magazine subscriptions. There was so much protest about your magazine however that on the 17th we again wrote you rescinding the cancellation and paying your bill. We are quite pleased to be subscribing to a magazine the editor of which takes enough interest in his job to be perturbed about losing a subscription."

Construction Company

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100% Paid Circulation.

Pictorial Presentation.

Large Page Size.

Impressive Roto-Printing.

No Engraving Costs.

Low Cost per Unit of Coverage.

Reader Interest!

These are excerpts from letters written by men who read CONSTRUCTION METHODS. They are only a few of the many that have been received during recent months, indicating a heightened reader interest and a *live* readership. What they think of their publication is important to us, but it is equally important to every advertising or sales manager who has the problem of picking the right media for reaching the construction industry.

Reader interest plus editorial leadership equals advertising value. You get that in CONSTRUCTION METHODS. Plan now to use its advertising pages for the remainder of 1933 and to make full use of its services during the whole of 1934. Our representatives will be glad to discuss with you the sales possibilities of today's market.

CONSTRUCTION METHODS 330 W. 42nd ST. NEW YORK, N. Y.

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Copy for New Advertisements Received Until Nov. 6th, for the November Issue

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for
IMMEDIATE SALE

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1—1931 Chevrolet Truck
1—1929 Dodge Truck
1—5-Ton Mack Truck
1—1931 Ford Truck

MIXER

1—1929 Ransome Mixer

SHOVEL

1—Marion Gas-Electric Shovel

PAVEMENT HEATER

1—Greco Pavement Super Heater

HOIST

1—1930 National Single Drum

SNOW PLOWS

2—1931 Sargent Hydraulic Snow Plows
1—1931 Frink 67-S Snow Plow

AIR COMPRESSORS; DRILLS

1—1930 Curtis Air Compressor
2—1930 Ingersoll-Rand Compressors
2—1-R Jack Hammers

CRANE

1—1929 Byers ½ yard Crane

TRACTORS

Tractor Equipment, Bulldozers & Creeper Wagons
1—1928 Caterpillar 60 & Bulldozer
1—Caterpillar 30
1—5 Ton Holt Tractor
5—75 Monarch Tractors
2—50 Monarch Tractors
2—Bulldozers for 50 Monarch
4—Creeper Wheel Wagons
4—La Plante Choate Wagons
1—Double Drum Winch for Caterpillar
1—1927 Fordson Tractor

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ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.

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↓
"CATERPILLAR" DIESEL
↓
OVER 50% FUEL SAVING
↓
10% INCREASED PRODUCTION

Above.. Requiring only 30 gals. of low-priced fuel every 10 hrs., this 1½ yd. Lorain-75B, powered with a modern, simple "Caterpillar" Diesel, is cutting gasoline gallonage and costs over 50%.. is loading wagons quicker, and more of them.

Below... One of three ⅜ yd. Lorain 30 draglines used by Fellsmere Sugar Co. where its lack of excess weight reduces ground pressures and otherwise contributes to improved low-cost operation.

WHY stand for the drain of obsolete equipment when modern, efficient Lorains will pay for themselves in economies and increased production... and will go a step further by adding to profits.

Write for descriptive catalogs, today!

THE THEW SHOVEL CO., LORAIN, O.
THE UNIVERSAL CRANE CO., LORAIN, O.

LORAIN 40·30
¾ - ½ - ⅜ YD.

LESS WEIGHT
↓
GREATER CAPACITIES
↓
LOWER PRICES
↓
HIGHER SPEEDS
↓
LESS OPERATING COSTS
↓
GREATER PROFITS

Widening out the old nine-foot concrete road to twenty feet.

Narrow link in U. S. 80 adapted to modern traffic

Mechanical finisher spreading new Texaco Asphaltic Concrete wearing surface.

The Texaco Asphaltic Concrete surface waiting for the roller.

Close-up of the non-skid Texaco pavement on U. S. 80 between Fruitvale and Grand Saline, Texas.

TRAFFIC outgrew the nine-foot concrete road on U. S. 80 between Fruitvale and Grand Saline, Texas. So the engineers put their heads together to decide the best methods of modernizing the old road.

It was decided first to broaden the old highway from nine to twenty feet, to provide adequate room for two-way traffic. The entire surface was then covered with a Texaco Asphaltic Concrete wearing course of the modified Topeka type. Non-skid, resilient and waterproof, this new, wider section of U. S. 80 will provide safe, smooth riding for many years.

Throughout Texas, hundreds of miles of main and secondary roads are protected against traffic and climate with suitable TEXACO Asphalt surfaces.

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Boston
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